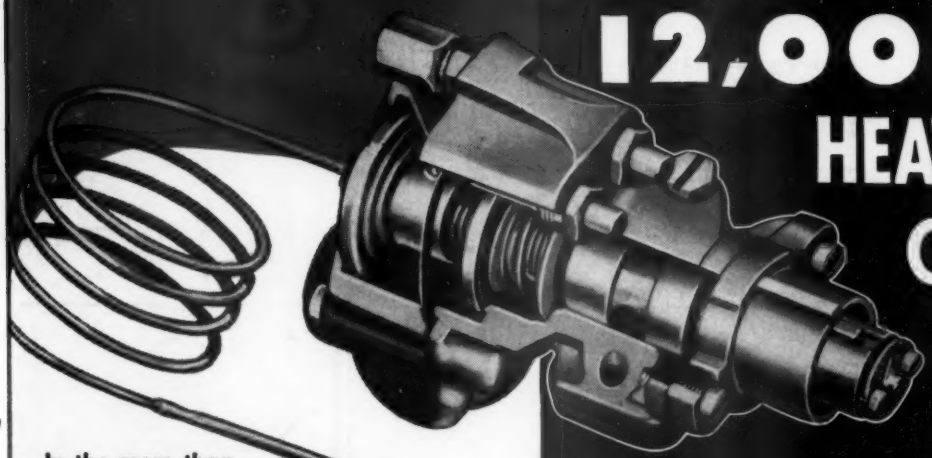
VOL. 174, NO. 1 AMERICAN JANUARY, 1951

Gas Journal

MAR 20 1951

THE KNOW-HOW THAT 12,000,000 HEAT CONTROLS CAN GIVE



MODEL BJ

In the more than fifty years that Robertshaw has manufactured controls, it has produced over 12,000,000 Model BJ thermostats which are in actual use.

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Among the many important features of MODEL BJ Controls are

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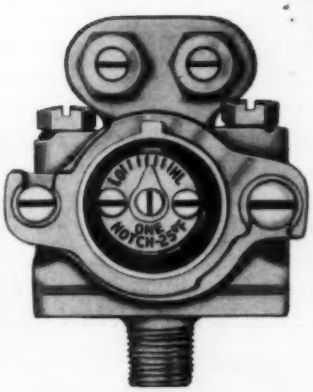

Calibration, bypass and pilot flame adjustments are made from the front of the control. Furthermore, the entire gas cock valve can be removed for greasing or cleaning without affecting the calibration.

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MAR 30 1951
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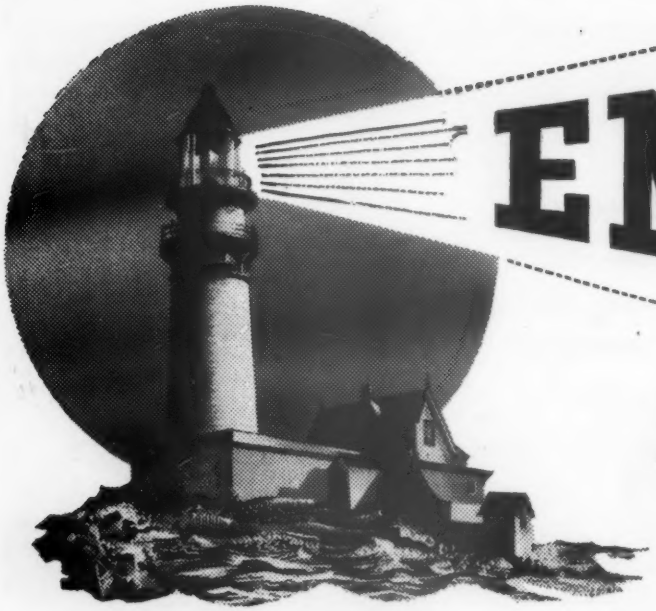

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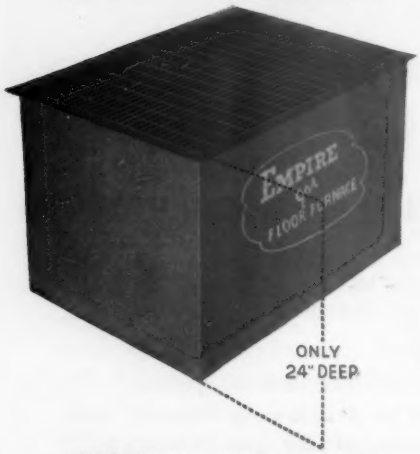

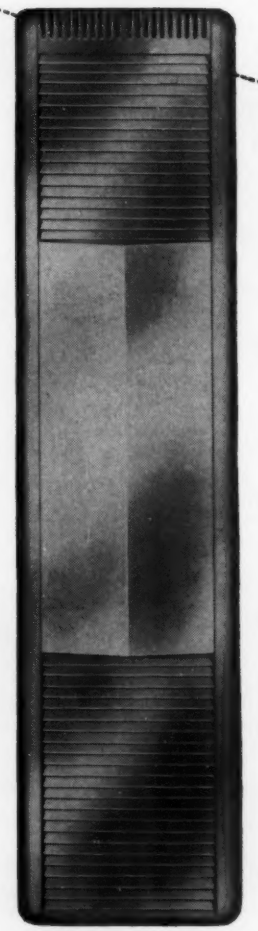

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AMERICAN Gas Journal
ESTABLISHED 1859

VOLUME 174 JANUARY 1951 NUMBER 1

This month...

On page 11 of this issue we launch the first chapter in our new series on *American Gas Fundamentals*. The idea has been a long time in the developing but we believe we have hit on the right formula: Contributors to the series will write about the industry in terms that anyone in the industry should be able to understand. *Fundamentals* is primarily intended for the younger audience, but we have no objection to our older readers reading through each installment just as a refresher on what they may have forgotten since they put their textbooks on the shelf.

Warm and pleasant memories are awakened by a little folder that has just come to hand, "The Pacific Coast Gas Association, Its History and Organization." It takes us back to 1925 when we first met Clifford Johnstone, then newly ensconced as secretary of the organization and now magnificently titled managing director. We thought then, and we are convinced today that Cliff is able to accomplish more, with less fanfare, than any trade association practitioner that we have ever met.

It is with a mixture of pleasure and regret that we announce that Arthur W. D. Harris, formerly associated with Conover-Mast Publications, Inc., has taken over the duties of L. V. Hohl, as vice-president and business manager of AMERICAN GAS JOURNAL, our former associate having resigned to set up shop as an independent publishers representative. We will be able to keep an eye on him, however, since he has opened his office in the same building with us, just one floor below our own. Arthur Harris built up *Aviation Age* from a mere gleam in the publisher's eye to one of the leading industrial publications in the country.

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Elliott Taylor · Editor

Howard F. Weeks · Associate Editor

Arthur Rohman · Western Editor **John F. Falvey · Financial Editor**

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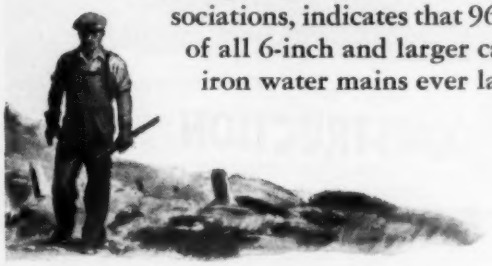
In spite of the unique requirement for membership, the Club roster grows, year by year. And why not, when a survey sponsored by three water works associations, indicates that 96% of all 6-inch and larger cast iron water mains ever laid



in 25 representative cities are still in service. And when answers to a questionnaire, mailed to gas officials in 43 large cities, show that *original* cast iron mains are still in service in 29 of the cities.

If your records show a cast iron main in service, laid a century or more ago, the Club invites you to send for a handsome framed Certificate of Honorary Membership. Address Thomas F. Wolfe, Recording Secretary, Cast Iron Pipe Century Club, Peoples Gas Bldg., Chicago 3, Illinois.

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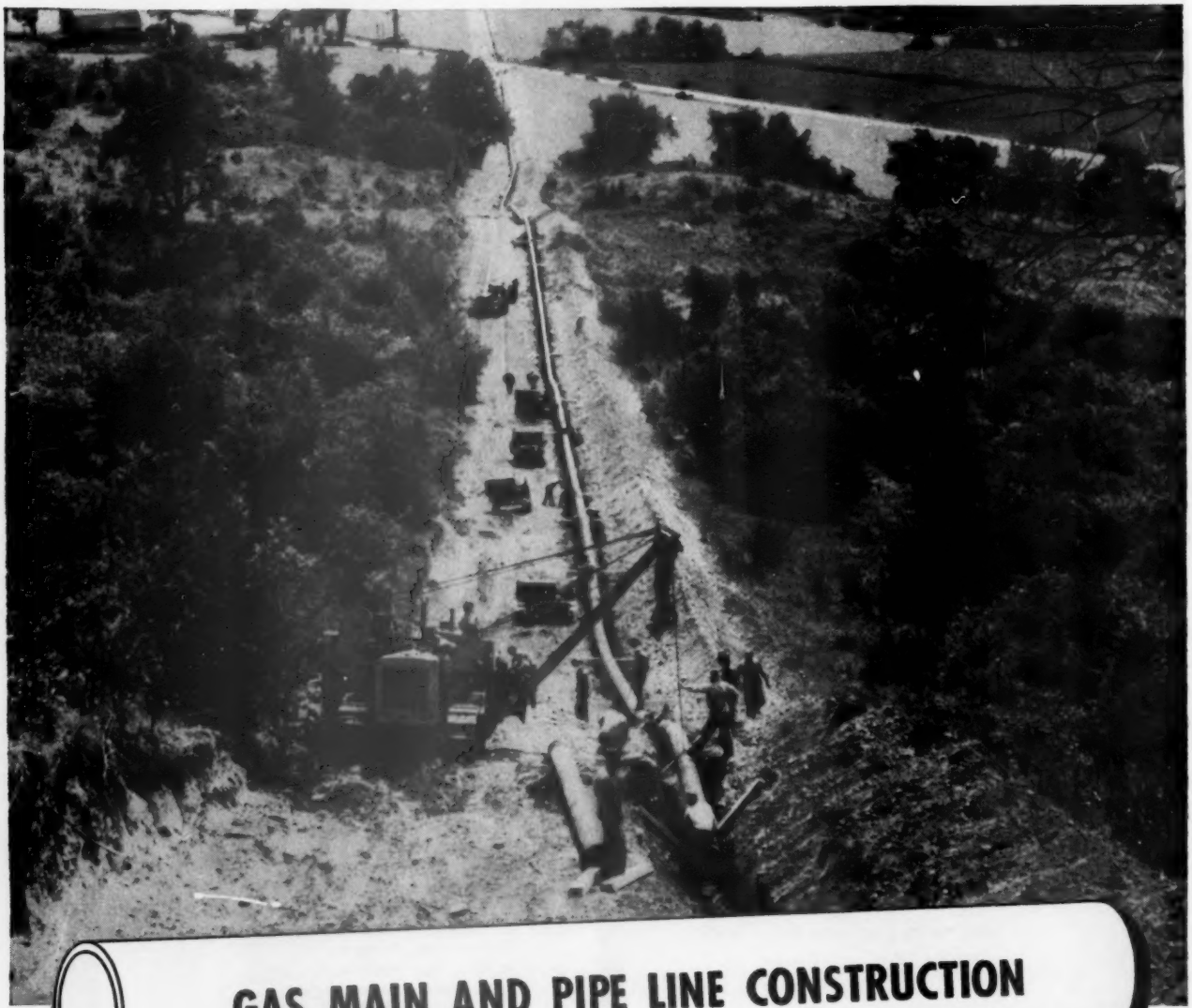
SERVES FOR CENTURIES



GAS MAIN AND PIPE LINE CONSTRUCTION

Photo Courtesy of
Niagara Mohawk Power Corporation

Early this year United Engineers re-entered gas main and pipe line construction. The current and completed work for utility companies consists of engineering and construction of distribution main extensions, river crossing designs, and construction management services for a lateral pipe line serving a gas plant from a main natural gas line distribution station. Field inspection and supervisory services are being furnished for several other cross country natural gas lateral pipe lines.

During the previous active period of this work, 159 installations of mains totaling over 1,000 miles in length were satisfactorily completed.

A working pipe line organization is again available to provide complete and flexible engineering, construction managing, and inspecting services for all phases of pipe line construction or any portion that may be required to augment the engineering and construction departments of utility companies.

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WITH A BACKGROUND OF OVER SIXTY YEARS' EXPERIENCE

WEATHER WORRIES?

GET RID OF THEM WITH THE

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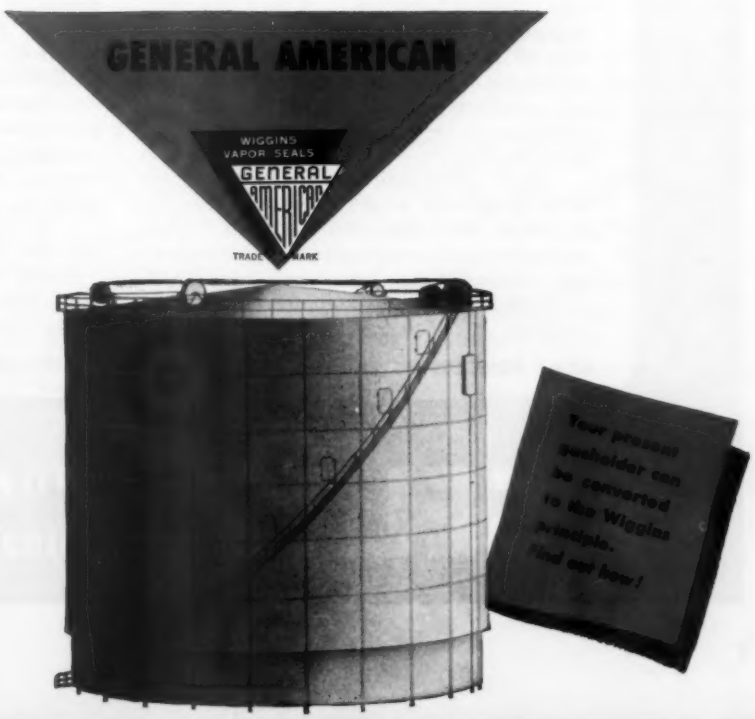
BY

Let the summer sizzle up to 110°. Let winter whip down to 50° below. No matter how extreme the temperatures, they can't bother the Wiggins Gasholder. Yes, it's basically different from all others, using an absolutely DRY, frictionless seal—proved gas-tight and impermeable by 15 years' use.

"Freeze-ups" are impossible—because there's no water to freeze, no tar, no grease to dehydrate. In the burning heat of summer, moisture can't adulterate stored gases—because there's no water to evaporate. Gases stay dry, pure, undiluted.

Impressive savings are obvious: Wiggins Gasholder design does away with need for steam coils, winter heating. No anti-freeze is required. Operating costs go down to zero—with no need for constant inspection and maintenance of seals. *Remote operation is now possible!* Absence of water or other sealant liquid permits construction with no heavy or complicated rigging. Even the foundation is lighter, for there is no heavy load of water to support. The Wiggins Gasholder is built to withstand heat, cold, ice, snow, wind, rain—and earthquakes! Operates at any pressure up to 20″ of water. Write for complete technical facts.



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Chemicals, paints, ceramics, glass, food, paper, textiles, printing, petroleum products —Selas Gradiation has improved the production methods of all . . . established new methods of heat processing.

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SELAS CORPORATION OF AMERICA
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Editorial:

The Fight for Survival

THE Gas Appliance Manufacturers Association now appears ready to embark on a publicity and public relations program in which the manufacturers of appliances and equipment will invest $180,000 a year. Carl Byoir and Associates, a firm of experts in the field of moulding public opinion have laid out a tentative program and presented it to all sections of GAMA, and all sections have approved. It now remains for the board of directors of the association to raise the money necessary to swing the plan into action.

The activity is long overdue; it is worthy of support by every member of the manufacturers' group; it can be made worth many times what it will cost if it is intelligently handled. And since we have long regarded Byoir as the best in the business, we have every reason to assume that it will be so handled. The final answer naturally will be found in the results achieved after the program has a year or so behind it.

To some manufacturers it may appear ill-timed to suggest such a campaign just as our nation enters a period that seems to be inevitably headed into a new world war. But we believe that the critical situation that lies ahead strengthens rather than eliminates the need for sound public relations on the part of the gas appliance or any other industry.

It is commonplace to refer to the coming struggle as a war for survival. But if survival is to mean anything, it has to mean much more than the mere emergence alive and unmutilated from the first sneak atomic attack. One of the fruits of victory must be the continued freedom of our institutions and our way of life. American industry has already learned through bitter experience that it is not enough for it to merely do its job as part of a united front against the alien aggressor. It must fight for its survival as a component part of free enterprise as well.

That is the fight that gas appliance manufacturers should understand that they are being asked to underwrite. Steel will be tight, so they cannot make their regular products; aluminum may all go for higher priority production. Many plants will be converted partially or entirely to war work. Some companies may have little to sell in the normal channels of trade; some may have nothing at all.

But good will and public understanding and acceptance will remain commodities that every business and every association must merchandise just as assiduously as they once merchandised ranges and refrigerators, industrial equipment and engineering service. There is no alternative that does not lead to post-war anonymity for the individual, and economic extinction for American enterprise.

And facing things realistically, business knows that in a war economy it does make money, only to have it taken away in taxes. If some of those legitimate earnings, before taxes, can be invested in the future, then that in itself is compatible with every apology or explanation for war that we have ever heard. We fight to-day so we may earn some security for tomorrow.

More on Conventions

OUR slightly critical comments on "Overgrown Conventions" in the November issue of AMERICAN GAS JOURNAL aroused considerably more response from our manufacturer friends than we had anticipated. More, in fact, than we are accustomed to receive on most editorials. Understandably enough, some correspondents are reluctant to be quoted, lest they arouse the ire of their utility customers. But without a single exception, every opinion expressed was in favor of the view taken in the editorial in question. In the aggregate they make it apparent, if it had not been apparent before, that the whole scheme of combining national AGA conventions with GAMA exhibits at the biennial Atlantic City conclave will have to be redesigned or replaced by something better.

We have become inured to the pained but forgiving silence with which most professional laborers in association vineyards greet our cheery and constructive criticism of their reasonably remunerative labors. But we do not believe that either GAMA or AGA can safely ignore comments from exhibitors who say: "Certainly the manufacturing groups of the gas industry can spend their limited promotion budget more effectively"; or ". . . we feel that we are being exploited by AGA and GAMA officials . . . in order that their egos may be bolstered by the extravaganza that they have promoted with apparent success." They cannot remain indifferent to the comment of one of the biggest exhibitors who observed: "Perhaps this analysis of the attempt of the manufacturers to keep up with the Joneses will have a sobering effect upon the value which some associations have placed upon exhibits and conventions."

We are more convinced than ever that the best and most effective avenue of group display for gas appliance and equipment manufacturers lies in regional or sectional presentations where each can show his wares only to that section of the gas industry that is primarily interested in his type of product.

Elliott Taylor

Announcing

American Gas Fundamentals

WITH this the first installment in its continuing series on *American Gas Fundamentals*, AMERICAN GAS JOURNAL launches what is conceived to be a new and increasingly essential service to the gas industry.

A comprehensive survey of existing study courses and educational material currently in use indicates a need for such a series. Virtually every gas utility has some system whereby on-the-job training is supplemented with at least a minimum of lecture, classroom or textbook instruction in theory. But very few have undertaken to prepare and make available to all of their employees courses or handbooks whereby the alert and ambitious student in any department may learn through planned study the fundamentals of every phase of industry operation. In many instances, companies lacking such media of instruction have expressed regret that none was available for general use.

This exposes a deficiency in the apparatus of gas industry self-education that requires correction. Since education is traditionally the primary function of an industry publication, it devolves upon AMERICAN GAS JOURNAL, as the oldest publication in the gas industry, to assume the responsibility for outlining and developing the courses that will achieve that correction.

American Gas Fundamentals will include new and original writing on many of the topics shown in the outline. On some subjects where existing industry education literature has proved adequate, adaptations will be made from courses already in use by operating companies.

Home study and university short courses, employee education plans, executive development, cadet and trainee programs of utilities all have played a part in the education of the young men and the new man in the industry. They have become recognized as the ladder rungs under the feet of men who are on their way to the top. Where such programs are already in operation, *American Gas Fundamentals* should be regarded as an adjunct to, rather than a substitute for the curricula that they embrace.

Although the courses are designed with younger personnel in mind, the material will also serve as refresher reading for seasoned operations men; and for gas industry executives who have left some of their operating experience behind them as their attention has turned increasingly to management and administration problems.

The whole program of American Gas Fundamentals is subject to expansion, should that be necessary to keep it abreast of new industry developments. The series as now planned will extend over a period of twenty-four months. It will be uniform in style of presentation and has been so designed as to encourage its removal from each current issue of AMERICAN GAS JOURNAL and retained in a loose-leaf folder as a growing text book of permanent reference value.

THE EDITORS

OUTLINE

Natural Gas

1. Geology
2. Drilling and Production

Manufactured Gases

1. Bluegas; carbureted water gas
2. Coke oven gas; producer gas
3. Reformed gases

Transmission

1. Pipe lines
2. Corrosion and pipe protection
3. Compressor stations
4. Super compressibility
5. Hydrates and dehydration
6. Gas conditioning
7. Flow formulae
8. Orifice meter measurement

Gas Storage

Gas Distribution

1. System design and operation
2. Pressure regulation
3. Measurement and accounting

Gas Utilization

1. Combustion characteristics
2. Domestic
3. Commercial and industrial
4. Interchangeability

Conversion Practices

Management Problems and Policies

1. Corporate structure
2. Public utility regulation
3. Public relations

How to Use the Material:

American Gas Fundamentals *is not intended as a training or service manual, but is rather a comprehensive compilation of basic gas facts that will guide you to a broader understanding of your industry as a whole, and will assist you in evaluating and solving the problems that will confront you as you advance with the growing gas industry.*

The series is designed to be removed from each current issue of AMERICAN GAS JOURNAL *and filed in a ring binder, where it may be accumulated into a text book that will be of permanent and lasting value. Material should be filed under the major subject head appearing in the upper right hand box at the head of each article, in this instance: Natural Gas. Sub topics will be numbered, as here: 1. Geology. The subject head and the number of the subhead will indicate the order in which future material should be filed in your loose leaf book.*

Mindful of the fact that many younger members of the gas fraternity may be required to serve in the armed forces of the country, arrangements will be made whereby every subscriber who enters the service will have preserved for him a full set of all of the texts that may be printed during his absence. Upon his return to the gas industry he will be presented with these installments complete, with the compliments of AMERICAN GAS JOURNAL.

AMERICAN Gas FUNDAMENTALS

NATURAL GAS
1. GEOLOGY

A CONTINUING EDUCATIONAL AND REFRESHER COURSE IN GAS TECHNIQUES, OPERATIONS AND MANAGEMENT

Geology and the Gas Industry

GEOLOGY is the science which treats of the earth, the rocks of which it is composed, and the changes which it has undergone or is undergoing. As a science geology seeks to interpret current observations through theories or hypotheses regarding the origin of these rocks that are a component of the earth's crust. These theories are of significance to the gas industry to the extent that the earth's history has hidden away, in its geological time chart, the mystery of the origin of natural gas and petroleum.

Various theories prevail concerning the origin of the earth as a planet separate from the rest of the solar system. One widely accepted theory is that two billion or more years ago, a star passed close to the ancestral sun, tearing loose from the fiery mass fragments that ultimately became the planets and satellites of our solar system. Our earth is one of the medium sized planets in this system.

Most geologists agreed that, regardless of its origin, the earth at one time must have been a white hot mass of gaseous material that solidified as it cooled down from its original temperature.

Since the outer portions cooled first, they solidified and formed the earth's crust. As the cooling process penetrated deeper into the earth mass, the interior shrinking process resulted in great upheavals, earthquakes and volcanoes, that broke through the outer crust. Thus mountains and valleys were formed.

During this early formative process there must have been a period of torrential and almost continuous rains that eroded away the surface of the mountains and carried the minutely small rock particles down to the newly formed seas. The sediment thus deposited did not remain forever in the bottom of the seas. Further internal upheavals originating deep in the earth raised the sea bottom into dry land again, which in turn became subject to further erosion into another sea or lake area. Also the sedimentary layers were covered sometimes by lava from volcanoes which cooled to form hard impervious layers interbedded with the sediments.

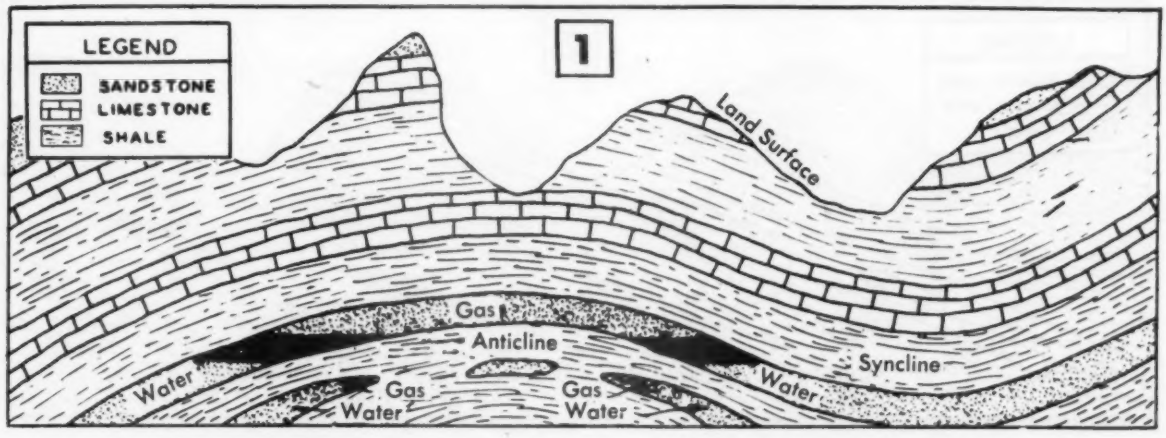
Classes of Rocks

Geologists divide the rocks that underlie the earth's surface into three great classes. They are: (1) igneous rock, which solidified from a molten condition; (2) sedimentary rock, which is a product of erosion and transportation of small rock particles to be deposited in layers; and (3) metamorphic rock, formed from either igneous or sedimentary rocks which have been altered since their deposition by chemical reactions resulting from high temperatures and pressures.

Both oil and gas are universally found in association with sedimentary rock, a fact that lends support to the theory that the source of petroleum was plant and animal material which flourished in the sediment at one time. This, the organic theory, is the one most widely held by present day geologists. But since oil and gas are fluid and thus able to move through the porous types of rocks, it is impossible to declare with finality just what may have been the source bed for any present pool.

It should be noted in passing, however, that there are several inorganic theories which seek to explain the formation of natural gas without the aid of living organisms.

PRINCIPAL STRUCTURAL CONDITIONS FAVORABLE FOR THE ACCUMULATION OF NATURAL GAS



Accumulation of Gas, Oil, and Water on Anticlinal or Domal Type Structure

Theories of Origin

One of the most important of the inorganic theories assumed that the interior of the earth at one time contained iron or other heavy metal carbides, which reacted with subterranean water to form petroleum hydrocarbons. Research work which shows that such hydrocarbons could be formed by the action of water on carbides lends some support to this theory. But there is no certainty that the earth ever contained the metal carbides that would have been required, and most geologists reject the postulate since there is no natural gas to be found in igneous rocks.

The much more widely credited organic explanation may be divided into two classifications: (1) the vegetable origin theory and (2) the animal origin theory.

A plausible speculation of the first type is that petroleum hydrocarbons were formed by the decomposition of immense quantities of gelatinous algae, a simple marine vegetation. The fact that at the present time petroleum is being produced in small quantities by the decomposition of seaweed in sand has been used to support this theory.

Since both plant and animal life flourished in the sediments on the ocean floors, it appears probable that neither plants nor animals were solely responsible for the origin of gas and oil, but rather that both were contributing factors. As this organic matter died and was subsequently buried by sediments that were deposited over it, it partially decomposed. But the ever increasing cover of sediments protected it from complete oxidation. Increased pressure and heat brought about a semi-destructive distillation of organic matter, resulting in the formation of gas and oil.

Scientists now believe that of the present-day petroleums, those which are rich in nitrogen had their origin primarily in animal matter, while other petroleum was mainly of vegetable origin.

Requisite Reservoir Conditions

There is lots of oil and gas scattered throughout the sedimentary rocks, but in order to have commercial value it must be collected into pools or reservoirs. These may be only a few hundred feet below the surface but the most important ones are much deeper. Some of these reservoirs are of vast area, others relatively small. The general requisites for the occurrence of natural gas in commercial quantities are: (1) porous rock to contain the natural gas; (2) an impervious rock cover to prevent it from escaping; (3) a geological structure which permits the gas from a wide area to collect in a restricted area.

The porous rock, usually sandstone or limestone, is called the reservoir rock. This rock strata, which varies in thickness from a few inches in some regions to hundreds of feet in others, may be referred to as oil and gas "sands." Natural gas and oil occupy the pore spaces or voids between the grains of the reservoir rocks.

All rocks contain open pore spaces between the grains or particles. This void space, called "porosity," ranges from 3 per cent of the entire bulk of the rock in fine-textured limestones and shales to 35 per cent in sandstones. In reservoir rock the void spaces are filled with natural gas, oil or water. When all three are present in the reservoir strata, gas will occupy the top section, oil the middle, and water the lower section.

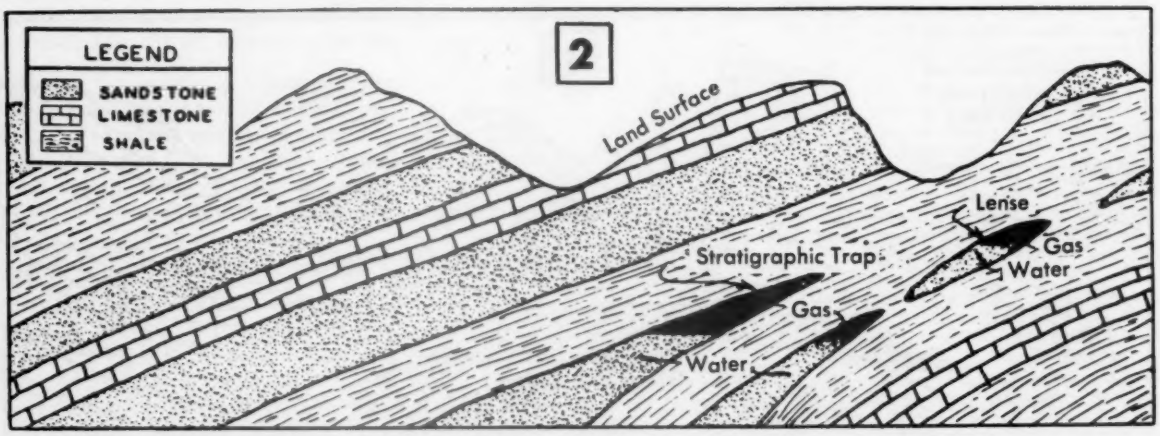
The impervious cover is called the caprock. This is usually shale or a very fine-textured limestone. If a reservoir is not properly capped, water will find its way downward from the surface and flush out the oil and gas. The formation underlying a reservoir must also be sufficiently compact to retain the oil and gas.

The geological structure favorable to the accumulation of oil or gas is one in which their migration through the permeable reservoir rock has been halted, causing a large accumulation in one area.

Due to the difference in the specific gravities of water, oil and natural gas, these materials separate out in the beds of the porous rock, with gas and oil concentrated in the upper concave downward portion of the strata (called anticlines or domes). If water is not present in the porous rock, oil may be found in the bottom depths of the folds which are called synclines.

Gas and oil may also accumulate along what is called a fault, in which an underground fracture or slippage has occurred, bringing a permeable or porous layer of rock into lateral contact with an impermeable one such as shale or limestone. Oil or gas moving through the permeable rock would thus be trapped at the fault line.

PRINCIPAL STRUCTURAL CONDITIONS FAVORABLE FOR THE ACCUMULATION OF NATURAL GAS



Accumulation of Gas, Oil, and Water on Monoclinal Structure Due to Stratigraphic Trap and Lensing

Geological Investigations

The sketches shown on these pages depict some of the structural conditions favorable for the accumulation of oil and gas.

Natural gas is obtained by drilling down, usually over one-half mile below the earth's surface, through the caprock covering into the porous rock in which the gas under pressure is stored. The pressure forces the gas upward through the opening produced by the drilling operation to the surface above.

A knowledge of geologic structural conditions and of the characteristics of oil, gas and water accumulations is of upmost importance in locating the hidden reservoirs of these valuable fuels. Extensive geological investigations must be carried on in order to determine where to drill.

A geologist assigned to a new area will attempt to determine where the conditions favorable to gas or oil production are found. First he may go to the mountains and study the upturned edges of the rocks that are buried beneath the plains. By a study of their structural attitude and inclination, how they are built and how they slope, he can gain some idea of the structure and characteristics of the same rock strata that lie buried beneath the plains.

The geologist has already made a thorough study of conditions under which oil and gas have been found in previously proved areas. His search is for conditions that appear on the surface to show promise of duplicating those producing conditions below the surface of the ground.

For many years the oil and gas industry was largely dependent upon geology based on surface indications and well logs. A well log is a detailed foot by foot record of the progress of a drilling operation and the rock formations encountered during the entire drilling period. To be of value it must reflect the character, position, thickness and nature of the beds penetrated, as well as the location and thickness of water sands, gas sands and oil sands.

Geophysical Studies

Especially in regions where there is a heavy cover of sand or gravel and where the bedrock does not outcrop at the surface these earlier methods of direct observation are not adequate and have been supplanted by new methods.

Within comparatively recent years methods have been developed for determining and studying subsurface geological structures by a new science which is called geophysics. In these methods the physical laws of magnetism, specific gravity and sound vibrations or waves, are applied, so as to give information regarding the conditions that exist thousands of feet below the earth's surface.

There are a number of geophysical instruments, but to the natural gas geologist three are of prime importance, namely: (1) the magnetometer, (2) torsion balance, and (3) seismograph.

The magnetometer is an instrument which measures the strength of the earth's magnetic field. Since the earth's magnetism is often abnormally high in oil fields, this instrument is used to locate places where such a condition exists.

The torsion balance is a specific gravity instrument used to determine the relative densities of materials. Since rocks in which petroleum is found are apt to be denser and more compact than surrounding rocks at the same depth, this instrument is of value to locate places that are favorable to oil and gas accumulations according to rock density.

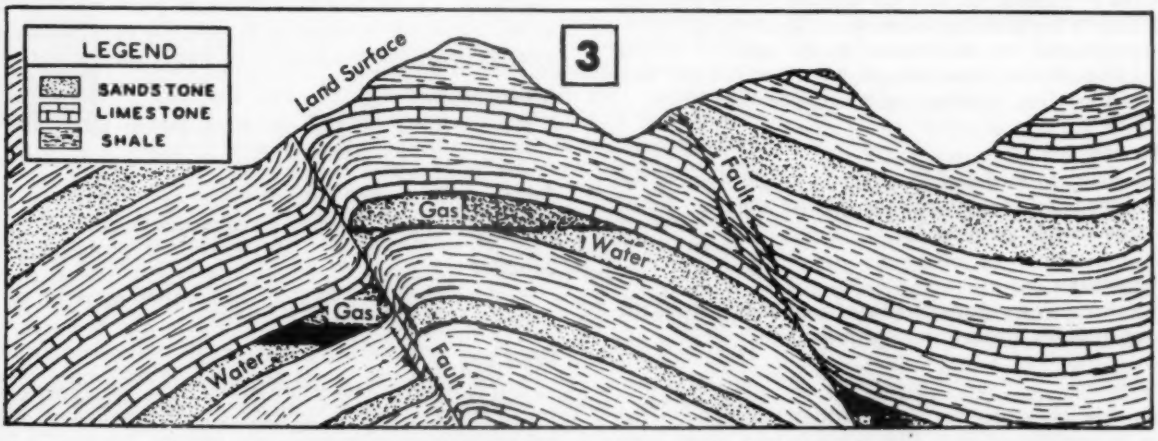
The seismograph is reasonably well known to all laymen as the instrument used to locate and record earthquakes, even those which may have occurred at distances thousands of miles from the location of the detecting apparatus. The seismograph has become the most important of all instruments used for subsurface geological studies. Its application to petroleum geology is based on the fact that earthquake or earth shock waves are transmitted through various classes of rocks at different velocities depending on the elasticity and density of the rocks encountered.

Sound waves travel with the velocity of about eleven hundred feet per second through air. Earth shocks travel with an approximate velocity of six thousand feet per second through rock near the earth's surface, and still faster underground. In fact it is said that shock will travel through dense rock or salt domes with a speed approximating sixteen thousand feet per second.

The Reflecting Seismograph

The reflecting seismograph is used to determine the distance and the attitude of subsurface formations. In its use

PRINCIPAL STRUCTURAL CONDITIONS FAVORABLE FOR THE ACCUMULATION OF NATURAL GAS



Accumulation of Gas, Oil and Water on Faulted Type Structure

an artificial earthquake is produced by burying and exploding from five to 50 pounds of dynamite in a shallow hole. For a distance of a quarter mile on either side of the hole is placed an array of geophones. These devices record electrically on a moving strip of paper, the shock waves received at each station. The strong shock of the initial explosion is followed by weaker impulses caused by sound waves reflected by rock layers at great depths. The time between the explosion and the arrival of each of these echoes is measured to the nearest thousandth of a second. If the travel time of the echo from a particular layer of rock is plotted on a map the dip and inclination of a bed can be determined. Thus the presence or absence of formations that are likely to contain oil or gas can be foretold. Sometimes it is possible to trace over very large areas the presence of a gas-bearing formation and to locate within rather narrow limits the area in which the accumulation is most likely to occur.

It should be noted, however, that geophysical methods do not eliminate all of the hazards from oil and gas prospecting. They can at best only locate areas where certain conditions favorable to production appear to exist.

Oil and gas frequently occur in structures and stratigraphic traps such as the updip wedge edges of sand bodies that end in an impermeable rock. Formations of this kind cannot be accurately predicted by any known method.

The importance of detailed geological studies cannot be overestimated. The whole pattern of natural gas expansion has been made possible through the discovery of new producing areas that were unknown as recently as 20 years ago. And so that this expansion may go ahead, and so that the large segment of the population that is now dependent on natural gas may continue to enjoy the comfort and convenience that its use makes possible, geologists are continually at work in the laboratory and in the field studying conditions of the rocks in an effort to locate new gas fields.

"Geology and the Gas Industry" was prepared under the supervision of Dr. Glenn G. Bartle, Geologist, and Provost of Harpur College, Endicott, N. Y.

Geological Terms

Anticline

An upward fold in the rocks. Anticlines which are important for accumulations of oil and gas are broad, gentle folds, usually several miles wide from syncline to syncline, with a total relief often limited to a few hundred feet or less. See Illustration 1.

Fault

Break in the rocks with upward or downward movement along a plane. The fault is favorable for gas or oil accumulation where a source rock of sandstone is brought into contact with an impervious formation such as shale. The migration of the gas or oil is stopped by this barrier at the fault line and a reservoir is formed. See illustration 3.

Mineral

A natural inorganic substance having a characteristic range of chemical composition and usually a definite crystal form of pattern. Oil and gas are not strictly minerals according to the geological definition. They are hydrocarbon compounds, but are referred to as "minerals" in the legal and economic sense. Hence, any reference to "mineral resources," or "mineral rights" includes oil and gas.

Monocline

A partially formed anticline, being a single slope of the formations which merge into the general slope or dip of the region. See Illustration 2.

Permeability

The character or characteristic of rock that permits the passage of fluids through its porous stratum.

Porosity

The void or open pore spaces between the individual grains or particles of rock. This porosity may range from three per cent of the entire bulk in fine textured limestones and shales to 35 per cent in sandstones.

Rock

Any solid mineral matter occurring within the earth—a chemical and physical unit of the earth's outer shell.

KINDS OF ROCKS:

Igneous—those formed by the solidification of magmas—derived from deep-seated molten masses and volcanic activity. Examples: granite, gabbro.

Metamorphic—those which have been changed from their original igneous or sedimentary character—by heat, pressure, recrystallization or cementation. Examples: marble (changed from limestone), quartzite (changed from sandstone), gneiss (changed from granite), slate (changed from shale).

Sedimentary—those formed by the consolidation of sediments or rock particles derived from pre-existing rocks, or chemical precipitation. Examples: sandstone, limestone, clay, shale, salt, gypsum.

Stratigraphic Trap

An accumulation of oil or gas due to the lateral discontinuity of a sand formation (lens or pinch-out), or due to the lateral discontinuity of the porosity in a sand formation (porosity pinch-out, porosity trap). See illustration 2.

Stratigraphy

Study of the origin and chronological succession of various rock formations.

Stratum

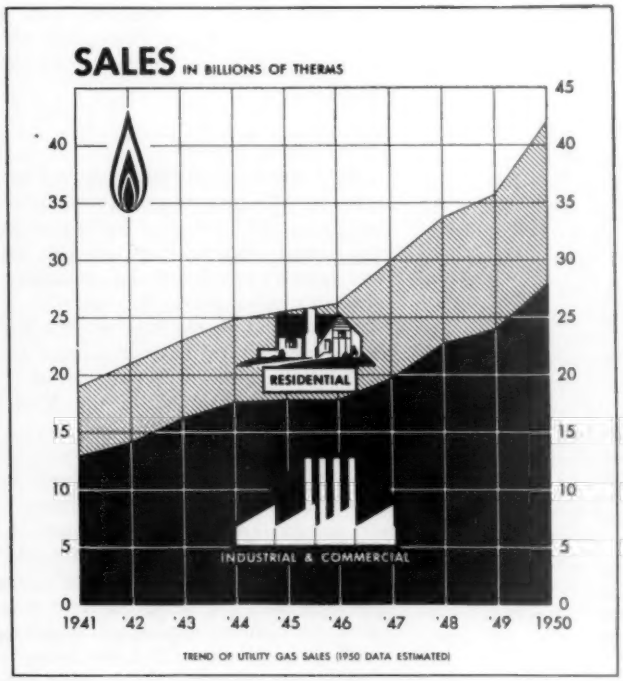
A layer of rock, usually a sedimentary rock.

Syncline

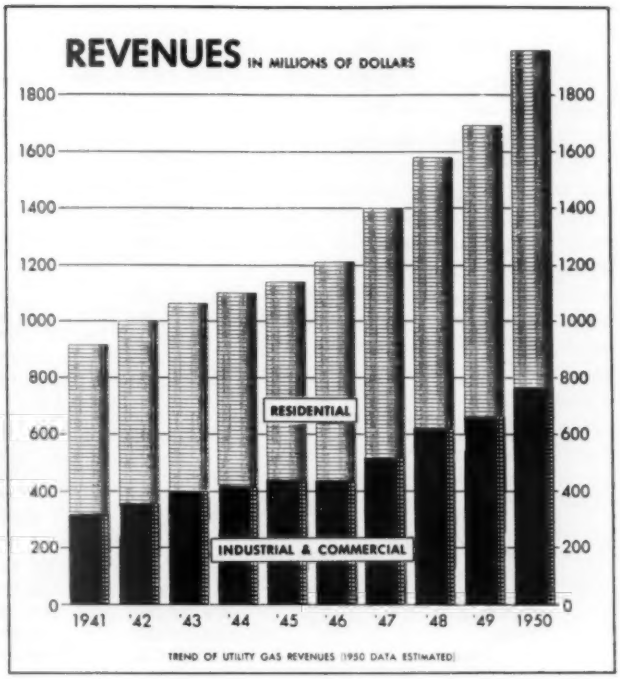
A downward fold in the rocks, or the opposite of an anticline. See Illustration 1.

Well Log

A foot by foot description of the rock formations penetrated when a well is drilled. Accurate well logs, when assembled in diagrammatic cross sections, are used to indicate subsurface structure and composition of formations encountered in any district under observation.



TREND OF UTILITY GAS SALES (1950 DATA ESTIMATED)



TREND OF UTILITY GAS REVENUES (1950 DATA ESTIMATED)

Come Peace or War Gas Industry Is Ready For the Uncertainties of 1951

by D. A. Hulcy

President, American Gas Association

President, Lone Star Gas Co., Dallas

D. A. Hulcy

EACH year since the end of World War II has seen the gas industry registering substantial gains in customers served, in volume of utility gas sold and in the amount of capital invested in plant and facilities. The gas industry has grown from a five billion dollar industry to an 8¾ billion dollar industry at the end of 1950.

This spectacular growth was particularly emphasized in 1950 when the gas industry achieved new records in numbers of customers served, in total volume of sales of utility gas, in total gas revenues and in numbers of gas appliances shipped. Capital expenditures for construction and plant expansion reached a new high level in 1950. The transmission and distribution systems of the gas industry today measure more than 375,000 miles, a record mileage for any of the nation's transportation systems.

Many uncertainties in both world and national outlooks make it difficult to forecast the future. The gas industry still has allocated, in its long-range program, nearly a billion dollars for its construction and expansion in 1951. Advertising and promotional plans of the industry for 1951 have as their goal a continuance of the gains made by the industry last year.

If peace prevails, there is every reason to believe the gas industry will enjoy a successful year in 1951. At the same time, our industry stands ready now, as it has in the past, to do its full share in helping our nation to meet any emergency that may arise.

The gas utilities at the end of 1950 were serving approximately 24,362,000 customers, including about 331,000 customers receiving LP-gas directly from utility gas mains. This was a gain of 3.3 per cent over 1949 when there were 23,580,000 customers on gas utility mains. Of the total number of customers served, 14,894,000 were receiving natural gas, a gain of 12.7 per cent over the previous year. Manufactured gas customers declined about 14.8 per cent during the year to total about 7,197,000 at the year end; while mixed gas customers on December 31, 1950 totaled an estimated 1,940,000, a gain of 24.8 per cent over 1949. The decline in the manufactured branch of the industry reflects the effect of the changeover by several large gas utility companies to the distribution of straight natural gas or to mixed gas distribution during the year.

Residential gas customers registered an impressive gain during the year, while commercial gas customers also increased substantially. In addition to the customers reported above it is estimated that nearly 6,000,000 customers now are be-

Total Gas Utility Industry Customers, Sales and Revenues, 1950 Compared with 1949 (Preliminary)

	1950	1949	Percent Change
CUSTOMERS (at Dec. 31)			
Residential	22,450,000	21,740,000	+ 3.3
Commercial	1,790,000	1,724,000	+ 3.8
Industrial	100,000	99,000	—
Other	22,000	17,000	—
Total	24,362,000	23,580,000	+ 3.3
CUSTOMERS (Average)			
Residential	22,165,000	21,264,000	+ 4.2
Commercial	1,735,000	1,657,000	+ 4.7
Industrial	99,000	97,000	—
Other	21,000	17,000	—
Total	24,020,000	23,035,000	+ 4.3
SALES (Thousands of therms)			
Residential	13,931,000	11,718,000	+18.9
Commercial	4,060,000	3,691,000	+10.0
Industrial	22,661,000	19,050,000	+19.0
Other	1,283,000	1,260,000	+ 1.8
Total	41,935,000	35,719,000	+17.4
REVENUES			
Residential	$1,195,000,000	$1,031,293,000	+15.9
Commercial	263,000,000	238,077,000	+10.5
Industrial	476,000,000	395,559,000	+20.3
Other	24,000,000	23,666,000	+ 1.4
Total	$1,958,000,000	$1,688,595,000	+16.0

ing served with LP-gas in territories not served by gas utility companies.

Total sales of gas in 1950 amounted to about 4,266,000,000 Mcf, a gain of about 15.8 per cent over 1949. Utility sales of natural gas were about 3,694,000,000 Mcf, a gain of 18.9 per cent; manufactured gas sales dropped to 412,400,000 Mcf, a decline of 2.7 per cent, and mixed gas sales were about 159,600,000 Mcf, a rise of 14.4 per cent over the previous year.

Revenues from the sale of gas reached an all-time record in 1950, almost to the $2 billion mark. Utility revenues for the year were $1,958,000,000, a gain of 16.0 per cent over 1949. Natural gas revenues staged a spectacular rise of 25 per cent to total about $1,363,000,000 for the year. Manufactured gas revenues were $458,700,000, a decline of 4.3 per cent under 1949, and revenues from sales of mixed gas were $114,600,000, a gain of 18.8 per cent over the previous year. The balance in revenues is accounted for by revenues from sales of LP-gas through utility mains.

New Facilities

The gas industry's expenditures for construction of new facilities and expansion of present production, transmission and distribution plant last year reached a record level of an estimated $1,060,000,000, attesting to the tremendous effort the industry is making to meet the constantly growing demand for gas. Of this total amount it is estimated that more than $954,000,000 was spent on construction and expansion of natural gas pipe line systems, with manufactured gas companies spending approximately $90,000,000 and mixed gas companies investing nearly $15,000,000 for new plant and expansion of present facilities.

The American Gas Association resurveyed the gas industry's expansion program last year and estimates indicated that about $3,154,000,000 would be spent in the five year period 1950-1954, with approximately $2.75 billion of this amount being devoted to construction and expansion of natural gas facilities. While it is believed that 1950 will be the peak year of this program, it is estimated that more than $875,000,000 will be spent on gas industry expansion next year if no restrictions are placed on vital materials.

Natural Gas Progress

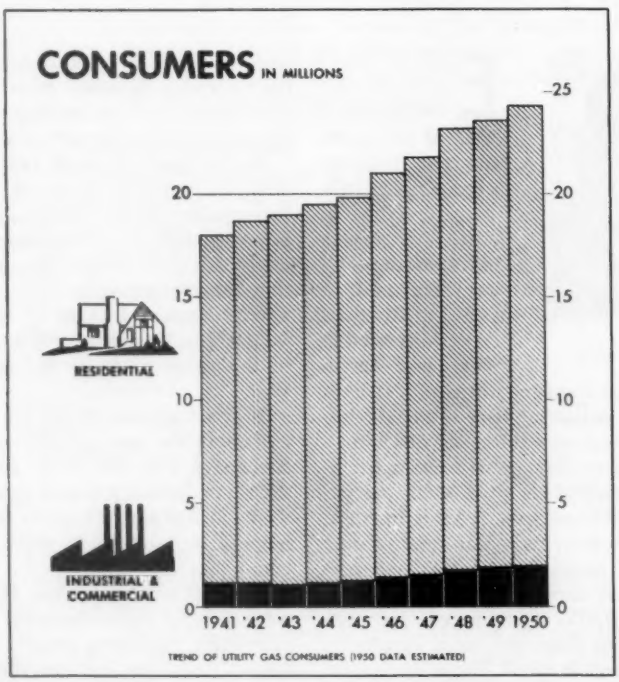
The natural gas industry reached new peaks in 1950 and showed every indication that it will progress further in the year ahead. Natural gas pipe line systems added record mileage, customers, sales and revenues as the natural gas branch of the industry reached new high levels, with natural gas supplying a record-breaking total of 20 per cent of the total energy consumed in the United States in 1950.

In the first nine months of 1950, the Federal Power Commission had approved construction of 5,750 miles of new natural gas transmission lines and had applications pending for an additional 12,400 miles. Construction of the approved lines will bring the total mileage of the nation's natural gas transmission lines to more than 265,000 miles.

The Transcontinental Gas Pipe Line Co. scheduled delivery of natural gas to New York City, Brooklyn and Newark for the end of 1950. This 1,900 mile line, the longest in the world, brings natural gas from the Gulf Coast to metropolitan New York and its cost was about $200,000,000.

The Federal Power Commission in November approved the application of Northeastern Gas Transmission Co. of Boston, to supply part of New England with natural gas. This company will serve markets in Massachusetts, Connecticut and New Hampshire.

The Algonquin Gas Transmission



Co., also of Boston, is expected to receive authorization to serve New England as soon as it has shown the FPC that it has an adequate supply of gas. Natural gas is expected to reach the New England states before the end of 1951. Only one important area in the United States will then be without natural gas, and several plans are under consideration for bringing gas to the Pacific Northwest. These plans include applications to bring gas to Oregon and Washington from the Texas fields as well as from the Canadian sources of supply.

Natural gas reserves continue to appear ample to serve the nation for many years to come, even with the rapidly increasing production of natural gas. The Association's Committee on Natural Gas Reserves estimated at the beginning of 1950 that proved reserves of natural gas totaled 180.3 trillion cu. ft., an increase of 6.5 trillion feet over proved reserves at the beginning of 1949. Natural gas production during 1949 was estimated at 5.9 trillion cu. ft., so new discoveries and extensions of estimates of known fields continue to exceed the yearly production.

Despite the tremendous growth of natural gas transmission systems, the manufactured gas branch of the industry continues to be of the utmost importance in the nation's economic picture. Demand for gas services continues to exceed the ability of the industry to serve this demand in many areas. This is particularly true as regards house heating and its attendant peak-load problems.

While some of the territories receiving or about to receive natural gas will change over to straight natural gas distribution, there are many companies that will continue to manufacture gas and will use natural gas only as one of the production materials. Other companies will mix manufactured and natural gas to be served, perhaps at higher Btu levels, but still relying heavily on the manufactured gas plants.

There are many factors that point the way to a continuation in 1951 of the record breaking achievements of 1950. Except for a few areas, the gas supply problem is rapidly being solved with the growth of the natural gas system and the technical advances in manufactured and mixed gas plants that are helping to meet peak loads. Our member companies continue to back their faith in the future of the industry with their contributions to the PAR Plan.

Rising costs of producing, transmitting and distributing gas indicate some further rate adjustments may be necessary, particularly if the tax burden of the gas utilities is increased heavily. Shortages of materials, resulting from a heavy conversion to war production, might necessitate delays in construction and expansion programs as well as limiting supplies of appliances. These are matters mostly beyond the control of the gas industry.

Gas Equipment Manufacturers Ready To Double Defense Contribution

by Frederic O. Hess

President, Gas Appliance Manufacturers Association

President, Selas Corporation of America

Frederic O. Hess

WE are about to begin a new year and recent announcements and events indicate clearly it is going to be different, substantially different. The true impact on our overall economy, and specifically our gas appliance industry, can hardly be predicted with any degree of accuracy. But we can, with certainty, review past performance and even though we are faced with controlling restrictions of our normal operations and production, plus many other uncertainties, we can derive some enlightenment and encouragement from such a review. The following resume of 1950 performance marks this year not only as a peak year for gas appliances, but it furnishes proof that our industry enters this critical period with more than double the facilities, the manpower and the productive capacity we commanded in 1941. We are therefore able as an industry, to make double the defense contributions. We can also maintain a reasonable production of our essential services; liveable shelter, food and sanitation.

The year 1950 saw practically all phases of the gas appliance manufacturing industry attain new sales peaks. For the first time, unit shipments of domestic gas ranges surpassed the 3,000,000 mark; automatic gas water heater shipments soared far above 2,000,000 units; while shipments of gas-fired, central, house heating equipment went well over the 1,000,000 mark. Incinerators, dryers and hotel-restaurant equipment were also well ahead of previous years.

It is difficult to determine the exact level of business activity for the coming year. The gas appliance industry recognizes 1951 as a year of confusion and uncertainty. Production levels during the coming year are dependent upon the availability of critical metals and production facilities allocated to consumer goods. Present estimates on the availability of metals and production facilities indicate a possible reduction of 20 to 30 per cent in gas appliance production next year.

This reduction will not permit the gas appliance industry to meet the ever-increasing consumer demands. We feel that this demand would have been difficult to meet under normal conditions. With the present international situation, we are committed to doing the best we can with the materials the industry can secure.

Our industry has faced a huge consumer demand, brought about mainly as a result of three basic factors. These factors are: The increasing replacement rate of retiring obsolete appliances; the normal growth of the gas industry which adds approximately 1,400,000 homes to its lines annually; and the introduction of natural gas through new natural gas lines, both completed during 1950 and now still in various stages of planning or construction.

Industrial Gas Equipment

Industrial gas equipment manufacturers also had a record year during 1950. This was due partly to the peak production enjoyed by all industries, but was mainly due to the ever increasing acceptance of gas as an industrial heating and processing fuel. The increase in the use of industrial gas can readily be illustrated by the steel industry which during the past year has consumed far in excess of 750,000 cu. ft. of natural gas per minute. That rate of consump-

tion, plus the realization that there are more than 2,600 industrial gas heat applications, indicates clearly that the forthcoming defense effort will put immense demands on the industrial equipment manufacturers, as well as pose a substantial problem on the gas industry as a whole. The required and necessary expansion of our total productive capacity will demand new gas facilities as well as a substantial amount of new gas equipment designed for war production.

Total Gas Appliance Shipments

A table showing the breakdown in units of various major gas burning appliances shipped during 1950, compared with 1949, is given here.

	1950	1949	Per cent Change
Domestic Gas Ranges	3,100,000	2,069,600	+ 49.8%
Automatic Gas Water Heaters	2,300,000	1,466,000	+ 56.9%
Gas-Fired Central Heating Equipment			
a. Furnaces	631,000	297,000	+112.5%
b. Boilers	82,000	50,000	+ 64.0%
c. Conversion Burners	368,000	290,000	+ 26.9%
TOTAL	1,081,000	637,000	+ 69.7%
Gas Floor & Wall Furnaces	650,000	372,000	+ 74.7%
Gas Direct Heating Equipment	2,100,000	1,453,000	+ 44.5%

Promotion

All promotional plans of the gas industry will be continued. Their execution during the coming year is entirely dependent upon the impact of the present increasing defense effort on the manufacturing facilities of the manufacturers involved and the credit or other governmental restrictions which may be in effect.

While gas range manufacturers are uncertain as to 1951 production, many executives think that competition for the consumer's dollar will be stronger than ever in 1951 and that aggressive selling will be necessary. Because of this feeling, the gas industry plans no relaxation of gas range promotion in 1951.

At the present time two big industry-wide gas range campaigns, plus continuing promotions every month, have been formulated. These activities include a spring festival and gas range style show in April, May and June, and an old stove round-up in September, October and November following the pattern of promotional programs that proved so successful in previous years. All activities will be geared to existing conditions. The AGA national advertising budget of $550,000 will concentrate on gas ranges and 16 gas range manufacturers will tie-in in national magazines. "CP" trade-paper advertising will also appear monthly.

The growing demand for household gas incinerators and gas clothes dryers has created a new and profitable market for dealers and manufacturers alike. Increased industry-wide promotions backed by dealers, gas utilities and manufacturers are planned for 1951.

Gas refrigerators will continue an intensified program of promotion and advertising of new models during the coming year.

Plans have been made for the active promotion of gas house heating in predominantly local campaigns sponsored by local utilities and including strong dealer tie-ins.

The manufacturers of gas water heaters will not continue with their present "Court of Flame" activity which has been conducted for the past two years. Instead of such a sales promotion campaign, aimed at the retail dealer, the manufacturers will sponsor a special health booklet designed to dramatize the necessity of adequate hot water service in our national emergency. It will be distributed throughout the nation to government agencies, national, county and state health groups. While the co-operative promotion in the gas water heater industry will be eased in 1951, most manufacturers plan to actively continue their own brand-name advertising and promotion.

Conclusion

In conclusion, it seems that the gas appliance industry can well view, with a substantial degree of satisfaction, this record of performance. Also, our industry should be able to face the future with some confidence that it can cope with the forthcoming difficulties and adjust itself to the national emergency. Flexibility and ingenuity will unquestionably be required and will be found within our industry.

FPC Names Loring E. Heckman Chief of Gas Certificates

The Federal Power Commission has appointed Loring E. Heckman chief of its division of gas certificates to succeed James V. O'Connor, who resigned recently to enter private practice.

Mr. Heckman joined the FPC staff in 1945, and has served as head of the gas resources section of the division of gas certificates since January of last year. Prior to his service with FPC, Mr. Heckman was division chief in the natural gas section of the Petroleum Administration for War, and before entering Federal service in 1942 was associated with the United Fuel Gas Co., of Charleston. He is a graduate of Rennselaer Polytechnic Institute.

Algonquin Uses Aerial Survey For New England Pipe Line

A detailed aerial photographic survey of the 250-mile route over which Algonquin Gas Transmission Co. plans to construct its New England natural gas pipe line is now in progress and will be carried on until the entire route between Boston, Mass., and Lambertville, N. J., is photographed.

The survey is being conducted for Algonquin by Eastern Aerial Surveys, of Boston, under the supervision of Ford, Bacon & Davis, the New York engineering firm which designed the Algonquin pipe line system.

The aerial survey will eliminate much of the land survey work which would otherwise be necessary. By using latest techniques of stereo-photography and aerial map-making developed during World War II, it is possible to get extremely accurate terrain information for use by pipe line engineers.

Algonquin's pipe line system is planned to start at Lambertville, N. J., where it will join with the Big and Little Inch lines of Texas Eastern Transmission Corp., which are now delivering gas into Staten Island, New York. From there, Algonquin's line will extend through New Jersey and New York, crossing the Hudson near Peekskill, and continue through Connecticut, Rhode Island and Massachusetts, to a point near Boston.

Tennessee To Expand Capacity To Serve Ontario Corp.

Tennessee Gas Transmission Co. of Houston has asked the Federal Power Commission for authority to carry out a $47,403,000 expansion program designed to increase its system capacity by 115,000,000 cu. ft. of natural gas per day which would be delivered at the United States—Canadian international border for ultimate consumption in Toronto and other markets in the Province of Ontario.

The project, which would increase the daily design delivery capacity of Tennessee's system to 1,425,000,000 cu. ft., would include a 45-mile line extending from Buffalo to a point on the U.S.—Canadian border near Niagara Falls. The 115,000,000 cu. ft. of gas would be delivered to Niagara Gas Transmission Limited, a newly-formed Ontario corporation controlled by Consumers' Gas Co. of Toronto, for resale to Consumers for distribution in Toronto, and for resale to other markets in Ontario.

Obtaining Lower Btu Gases by Blending Natural Gas with Other Gases or Air

by Edmund C. Powers

Educational Director, Compressed Air and Gas Institute, Cleveland

THE *increasing* supply of natural gas has brought with it varied new problems. Natural gas has a Btu content of about 1000. If a lower Btu gas is desired for distribution, it may be obtained by blending the natural gas with manufactured gas, coke oven gas or air. Where the supply of manufactured gas is fixed, and the supply of natural gas increases, it becomes necessary to blend with air.

One method of blending air and natural gas is by the use of rotary positive displacement blowers and gas pumps.

By directing the stream of high pressure natural gas through a positive displacement gas pump, it is possible to drive the pump as a motor thus obtaining power at the shaft. Since in most cases the pressure of the natural gas must be reduced from the transmission line pressure, the power is obtained virtually free.

A low pressure type compressor is connected to the "gas motor." Since a positive machine puts out a definite amount of fluid per revolution, it is possible to obtain a definite air to gas ratio. With a change in demand the gas flow will decrease, slowing the gas motor and slowing the blower, creating less air. However, since the two machines are handling fluids of different densities and possibly different temperatures, their "slip" is not the same. Also the blower will have negative slip while the gas motor has positive slip. In order to make the two machines "track" over a wide range, it is necessary to make certain additions to the system.

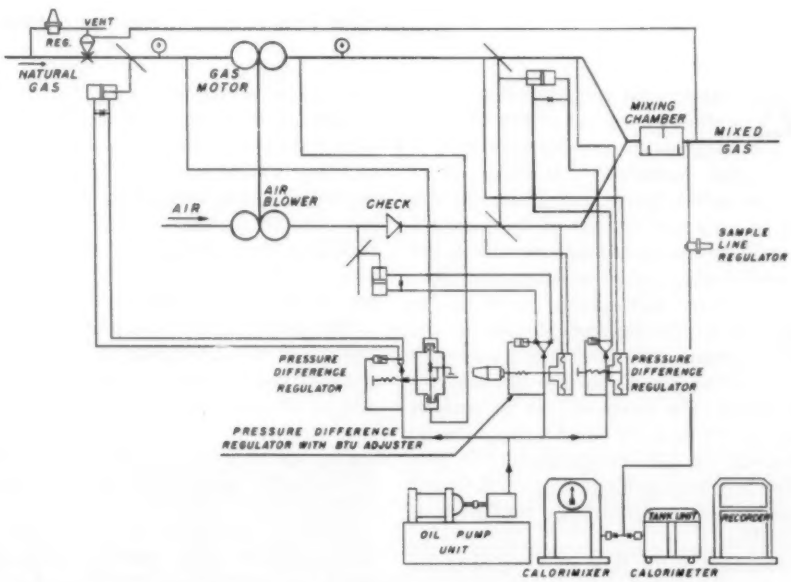
One method, which allows variation over a wide demand range as well as a Btu range, is shown by the drawing. Natural gas will be reduced from some high pressure through a pressure regulator to a pressure that the gas motor can handle. This will be set to maintain the desired mixed gas pressure. Downstream from this regulator is a butterfly valve controlled by a pressure difference regulator to maintain a constant pressure drop across the gas motor.

The gas motor is direct connected to a positive displacement blower. The blower is slightly over-sized so as to always put out an excess of air. When an excess of air exists, the bleeder or vent valve will be opened and bleed air in the proper amount to match air demand. This vent is controlled by a butterfly valve which is positioned by a pressure difference regulator with Btu adjuster. This regulator receives its impulse from across the flow measuring butterfly valve in the main air supply line. Upon a deficiency of air the air vent would close. This method of operation always insures a continuous supply of air for gas mixing.

As can be seen on the flow sheet, two proportioning butterfly valves are provided which operate from two pressure difference regulators. The one valve is installed in the main gas line to provide measurement of natural gas flow and the other butterfly valve is installed in the air line for air flow measurement. These two butterfly valves are mechanically connected together so that they move in unison to meet the demand for gas. These are positioned by the differential pressure regulators.

Because of the possibilities of pulsations, particularly in the air line, small stabilizing tanks should be located in the pressure impulse lines to the regulators. Pulsation can cause errors in pressure impulses to the regulators, so precaution must be observed in reducing these to a minimum. The calorimetric controller must be adjusted to particularly compensate for these conditions, as well as for the normal errors in gas and air proportioning. These tanks consist of a small piece of six-inch pipe, 15 to 18 inches long, with the inlet and outlet located at advantageous points.

The recording calorimeter is used to determine and permanently record, in Btu's, the calorific value of the gas. This calorimeter not only records the heating value of the gas but automatically supervises the setting of the calorimixer controller.



Sketch showing flow chart of one set-up for reducing natural gas pressure to maintain a required gas-air mixture.

THE GAS ORIFICE METER—2:

Recording Instruments—Mercury Manometer Type

by L. K. Spink

The Foxboro Co., Foxboro, Mass.

AN instrument for recording differentials of the gas orifice meter is constructed on the principle of a mercury manometer. It differs from the mercury U-guage in that the rise and fall of only one surface of the mercury is used. In the recording instrument, the chamber areas are proportioned so that, for the rated differential range of the instrument, the mercury surface in the float chamber will move just far enough to move the pen across the full scale of the chart. The range of the instrument may be changed by substituting a range chamber of different diameter, in this way absorbing more or less of the total travel of the mercury in the inactive chamber.

The size of the float and the distance which it moves govern the power available to overcome normal plus accumulated friction of the mechanisms. For this reason gas meters are made with mercury displacement much greater than that required to obtain a satisfactory calibration when in new condition.

It should be remembered that time is a factor in the calculation of gas flow through the orifice meter, so the accuracy of the timing element which rotates the chart is an important part of the entire picture. The chart drive speed must be such that varying flows do not show up merely as a wide record, otherwise serious errors may occur in judging the properly weighted average rate of flow. A slow response is to be preferred to an unreadable chart record. Damping adjustments are provided in most mercury float type meters to slow down the flow of mercury to and from the float chamber.

Since the pressure pen of a gas flow meter is driven by an element having a rotary motion, some means of converting the linear motion of the float to rotary motion without introducing angularity effects must be devised in order to fit both records to the same chart scale. One meter uses a segmental arc driven by special stainless steel chains with a light spring to eliminate slack. This gives uniform multiplication—similar to the action of a rack and pinion but without lost motion. Another type of meter uses a sliding lever linkage. A third design uses a short angular travel to minimize the effects of angularity.

The usual pressure element is a hollow coiled tube flattened to an elliptical cross-section. Pressure applied to the inside of the tube tends to change the ellipse to a circle, and in doing so causes the spring to uncoil. The motion from the movable end of the coil is used to drive the pen.

For very low pressures, this type of element does not provide sufficient power, so a bellows or diaphragm type of spring is used.

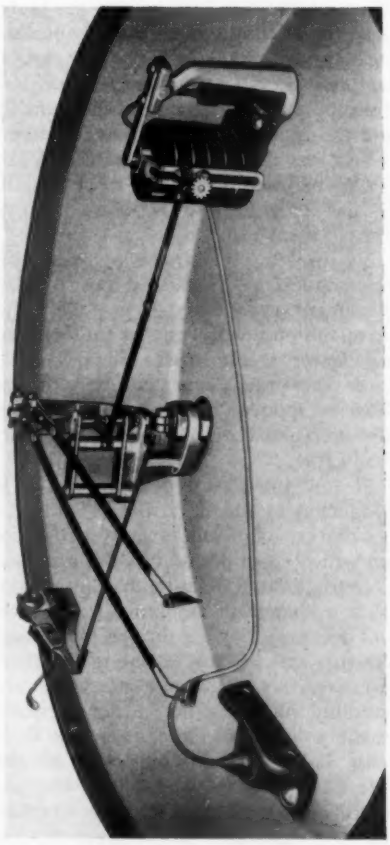
Pressure pens are usually checked against a dead weight tester or against a sensitive pressure indicating test gauge which itself is standardized periodically against a dead weight tester.

Checking and Calibrating

The differential pen is usually checked in the field against a mercury manometer; in the shop, against a water manometer or water column.

It should be recognized that many of the same problems of design, construction, and operation exist in the calibrating manometer as are present in the differential recording instrument. There are almost as many possible sources of error. Many precautions are necessary in order to insure an accurate calibration check. In the first place, a test should never be made without both the recorder pen and the water column at complete rest. This means that accurate calibrations should not be attempted with a leaky system.

The calibration of the well type manometer is dependent upon the ratio of area of the tube to that of the well, and



Static pressure movement.

whenever a glass tube is broken and replaced the calibration should be rechecked. The water column should be run up and down several times to wet the wells and avoid a false meniscus. Most accurate results will be obtained if the bore of the glass tubing is ½" or preferably ⅝" in order to obtain a flat water surface to sight across, but if this size tubing is used, it is necessary either to rezero the column to the level of the water in the pot before each test or to

modify the scale to take care of the displacement of water in the pot.

Possible Sources of Inaccuracy

The most common sources of inaccuracy in the differential recorder are changes of zero due to changes in level or loss of mercury, and imperfect arcing of the pen caused by bending of the pen arm. Both of these troubles may be checked and corrected without a manometer calibration. Many companies make a practice of having the meter zeroed daily when the chart is changed, since zero is the starting point of all calibrations and the meter cannot be correct if zero is inaccurate.

Other sources of inaccuracy are developed more slowly. Interference with the meter operating mechanism is usually apparent immediately after the meter is installed or after service work has been performed on it and does not develop when the meter is in an undisturbed operation. Deposit on the walls of the chambers altering the chamber area ratio occurs extremely slowly on clean gas service; likewise, excessive friction due to dirt, corrosion, or hardening of the bearing lubricant occurs extremely slowly. A recent survey among a number of leading gas measurement men indicated that the majority felt that a complete calibration once every six months or a year was all that was actually warranted, although some gas purchasers insisted on calibration checks as frequently as once every two weeks.

In spite of the many precautions necessary to insure accurate operation of the orifice meter, it is still one of the easiest types of large volume meters to install, check, and service and keep in accurate operating condition. Numerous reports of almost unbelievable agreement between check meters justify the universal faith placed in this type of meter by the natural gas industry. It has become the accepted standard for metering large industrial loads, flows at city gate stations, purchase and sale between distributing company and pipe line transportation company, dispatching purposes, etc. It is even widely used as a calibration standard for displacement and other types of large volume flow meters.

Dual-Bellows Type

by Claude B. Nolte

Barton Instrument Corp., Los Angeles

BELLOWS-TYPE differential pressure meters, also called dry or aneroid flow meters, are used to measure the rate of flow of gas in pipe lines for accounting and operating purposes. Such a differential meter becomes a flow meter when a restriction, such as an orifice plate, is installed in the pipe line and the pressure difference created across the plate by the velocity of the flowing fluid is measured. Because the pressure loss across the restriction is proportional to the square of the velocity, the differential pressure meter is used in this manner to measure flow, not in a direct fashion but by inference.

For convenience, however, the meter can be calibrated to read in units of flow instead of differential pressure. The record of the instantaneous flow rate is traced on a circular chart to provide the operator with a permanent description of the demands on any specific pipe line at any time. Simultaneously, the static pressure is usually measured, and recorded on the same chart. The chart can then be processed on a manual or semi-automatic integrating device to determine the total quantity of gas passed during the recorded period which may be 12 hours, 24 hours, 48 hours or 30 days.

Portable bellows-type differential meters are used for checking large, positive displacement meters for loads in excess of the meter's capacity during periods of peak demand. This is done by measuring the pressure loss across the meter for a 24 hour or seven day period. Portable meters are also used in making various flow rate surveys where a permanent installation is not practical.

The rupture-proof dual-bellows-type, or mercuryless flow meter.

Basically, the bellows-type meter consists of two pressure chambers separated by a flexible metallic bellows which is deflected in proportion to the difference in the pressures applied to the two chambers. There are two general forms of this meter: The earlier style which contained a single bellows, and the more recent type which contains a liquid-filled, dual-bellows arrangement which is not damaged by overloads.

The rupture-proof dual-bellows-type flow meter consists of two stainless steel bellows mounted on opposite sides of a central plate. (See illustration) The exterior of one bellows is exposed to the higher pressure, the exterior of the other bellows exposed to the lower pressure. The two bellows are mechanically linked by a stem which passes through a hole in the central plate and is attached to the closed ends of each bellows. On the stem are mounted two valves, one of which seats against the center plate when the normal bellows travel in either direction is exceeded. This bellows assembly forms twin chambers joined by the annular passage between the central plate and the valve stem. These chambers, formed by the interiors of the bellows, as well as the annular passage between them, are completely filled with a low freezing point liquid and sealed. No trace of air is permitted to remain inside.

When two slightly different pressures are applied to the meter housings, both bellows move simultaneously (in the direction of the lower pressure housing) because they are mechanically linked. The bellows chamber on the higher pres-

sure side decreases in volume slightly while the opposite one increases a corresponding amount. While this is happening, the fill-liquid must travel through the annular passage from the high pressure to the low pressure chamber. This liquid transfer continues until the allowable movement of the bellows has been reached; then one of the valves, mounted on the connecting stem, seats on the central plate. The remaining liquid in the higher pressure chamber is trapped and, because the liquid is non-compressible, acts as a support for the bellows if the pressure around it rises to excessive levels without a corresponding increase in the lower pressure housing. In other words, the instrument is protected against overloads of differential pressure up to the safe working pressure of the housings which may be either 1000 psi, 2500 psi or 4500 psi. Because the connecting stem has two valves, one for each chamber, the overload may be safely applied in either direction without damage.

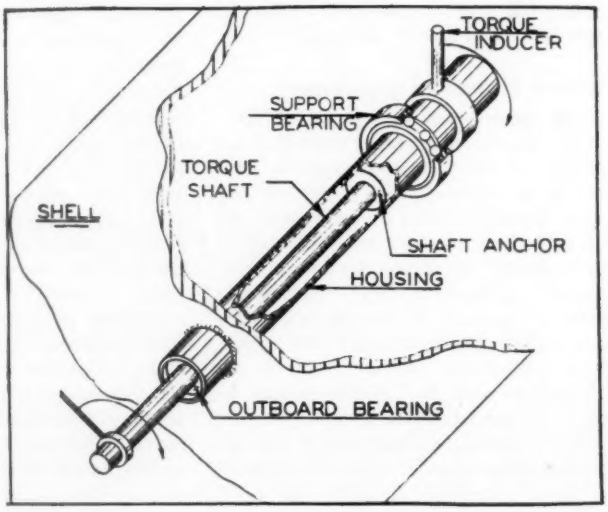
The movement of the connecting stem, which is proportional to the applied differential pressure, is transferred to the recording mechanism through a drive arm which actuates a torque-tube. The torque-tube makes possible the transfer of a rotary motion from within the pressured chamber to the outside without possibility of leakage or friction and without need for periodic lubrication.

Construction of Tube

While the use of the torque-tube is not new in the instrument industry, it may be worthwhile to review its construction briefly. It consists of a thin-walled tube with one end welded, or otherwise permanently sealed, to the wall of the pressure chamber; and the inner end welded to a small shaft which passes through the tube. The inner end of the tube and the outer end of the shaft are supported on suitable bearings. If an arm, fastened to the inner end of the tube (where the tube and shaft are welded) is rotated, the thin tube twists, while the shaft rotates through the same angle as the arm. The force required to twist the tube becomes a part of the instrument calibration.

The torque-tube assembly is sealed inside the bellows mechanism and can contact only the clean permanently sealed, fill-liquid. This construction makes possible the use of needle and ball bearings which insure high instrument accuracy and responsiveness. Typical sensitivities run as high as one part in 5000.

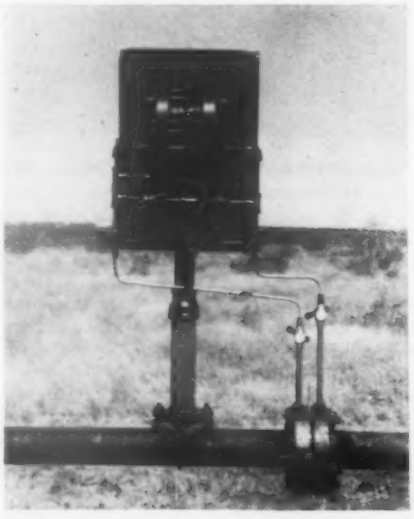
Recording flow meters for the gas industry must be capable of adjustment in the rate of responsiveness. When minor line surges in density or flow, caused by



Schematic drawing of the construction of the torque tube.

such things as compressors or control valve noise, are encountered, the operator must be able to select the required degree of dampening action; otherwise, the record on the chart will be blurred to the point that it cannot be interpreted. Also, it has been shown in test studies that even if the recording meter faithfully registers every variation in density, which appears as a change in differential pressure across the orifice plate, and if these are all instantaneously integrated, serious errors in flow measurement will occur because these variations, produced by pipe line noise, do not reflect flow variations. For this reason, excessive instrument response is undesirable.

Dampening action in the rupture-proof, dual-bellows flow meter is accomplished by controlling the rate of flow of the fill-liquid from one chamber to the other. This is arranged by installing a free-floating restriction ring on the connecting stem in one side of the central plate. This drastically impedes the flow of fill-liquid. Control over the flow of fill-liquid, and thereby instrument responsiveness, is attained by permitting a portion of the liquid to pass through a needle valve by-pass. In this way, the necessary response rate can be selected while the meter is in service and under pressure. There is always some leakage past the restriction ring; therefore, even with the by-pass valve completely closed, there is no possibility of locking the meter. Under such circumstances, the rate of response of the meter will be very slow, indeed, but nevertheless continuous.



Meter piping arrangement.

The differential pressure range of the meter is determined by the magnitude of the forces which oppose the movement of the bellows. These forces are supplied by the bellows, the torque-tube and the range springs. The forces from the first two items remain constant; the strength of the latter can be varied to supply a wide variety of differential pressure ranges. Typical differential pressure ranges are 0-20″ wc, 0-25″ wc, 0-50″ wc, 0-100″ wc, and 0-300″ wc. Changing from one range to another does not alter the physical bulk of the meter and can be accomplished readily by the user simply by exchanging the range spring assembly.

The rotation of the torque-tube shaft is transmitted through a system of links and arms to the pen shaft. As in the case of pressure or temperature measuring systems, final calibration of the instrument to the desired range is made by altering the length of an adjustable arm. This means, the meter does not require dismantling should a minor correction in calibration ever be required.

A minimum type of meter piping arrangement requires, in addition to the

(Continued on page 48)

Southern California Gas Uses Teletype To Speed Customer Billing

by Arthur Rohman

THE Southern California Gas Company is experimenting with a unique method of improving the efficiency of its billing operations in one of its outlying divisions.

Latest wrinkle has been the use of teletype machines to transmit accounting information for billing purposes over a leased telephone wire between the company's Visalia office 200 miles upstate in the heart of the San Joaquin Valley to the tabulating section of the main office in Los Angeles.

According to Manager R. F. Ogborn, of the company's customers department, it is believed that this is the first attempt on the part of a utility to adopt teletype methods used so effectively by the armed services during the war for the high speed daily transmission of information from every part of the country to the Pentagon in Washington.

The new system, in addition to being cheaper than any other method currently plausible under existing conditions, results in a number of advantages to the company.

1. While the new system eliminates domestic and commercial billing at Visalia for the San Joaquin Valley division, it permits the servicing of the Division's 45,000 accounts much faster and with no additional capital investment in machinery.

2. Space is saved at Visalia through the elimination of worn out and obsolete equipment.

3. The new method permits the compilation of statistical information useful to other departments of the company as a by-product to the billing procedure.

4. The time-loss and hazard of mailing the meter books between the two offices is eliminated.

5. The billing work is absorbed in Los Angeles without the addition of new machines or the hiring of additional help.

The new transmission system was set up by the company with the cooperation of the telephone company and International Business Machines Co. The set up consists of a new TWX teletype sender in Visalia and a TWX receiver in Los Angeles. The equipment installed at Visalia includes an IBM tape punch which translates the information contained in the meter books into a series of holes on a paper tape, which passes through the teletype sender, reading the information punched into the tape and transmitting it over the leased company wire to Los Angeles. Only one operator is required to tend the sending equipment in Visalia. Otherwise the operation is completely automatic. All transmission is done after six o'clock in the evening when the line is not normally in use.

The modern age gets another demonstration in customers department of Southern California Gas Co. Carolyn Burt, of tabulating section in Los Angeles, demonstrates new IBM tape-card punch which translates meter book information from a teletype punched tape. Information concerns meter readings in San Joaquin Valley division.

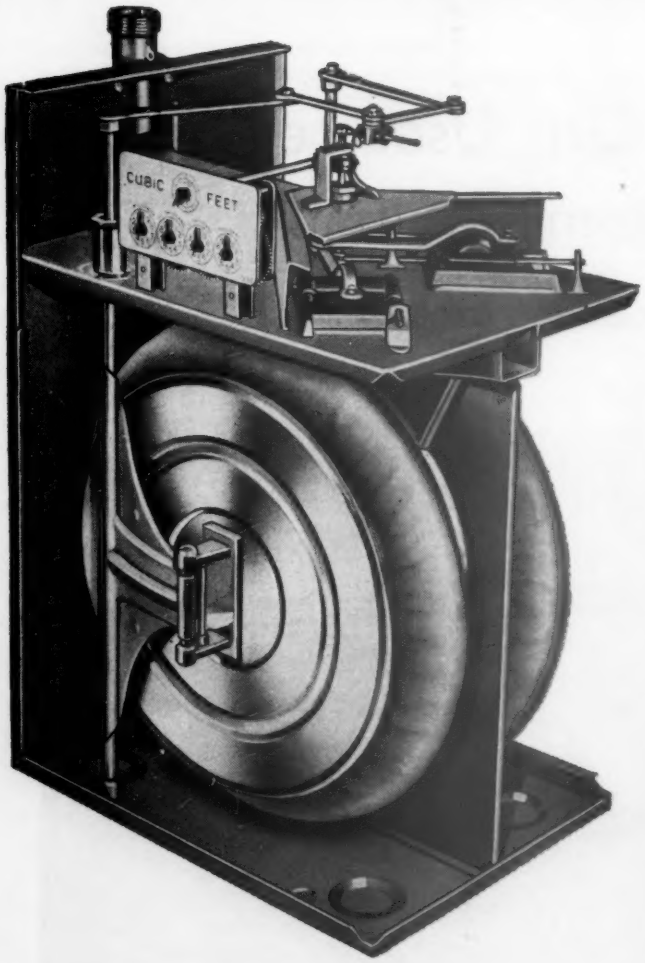
At the Los Angeles end of the line is another teletype machine which receives the phone message and cuts a duplicate tape. This tape is then placed in an IBM Tape Card Punch which transfers the information from the tape to IBM cards which are the same as those used in the Los Angeles office for producing customers' bills for the Los Angeles county area. The cards are then placed in the regular IBM machine and bills for the San Joaquin Valley division are printed. Bills are mailed from the Visalia office.

The new method of transmitting information by utilizing equipment already on rental in Los Angeles and by renting additional teletype machines and the tape card punch costs less than any other system considered, either because of additional capital investment in replacement equipment cost, or greater equipment rental cost and monthly payroll.

AGA Announces Time and Place Of Two Conferences

The AGA Distribution, Motor Vehicles and Corrosion Conference for 1952 will be held at the Benjamin Franklin Hotel in Philadelphia on April 7, 8, and 9.

The AGA Production and Chemical Conference for 1952 will be held at the Hotel New Yorker in New York City May 26, 27, and 28.



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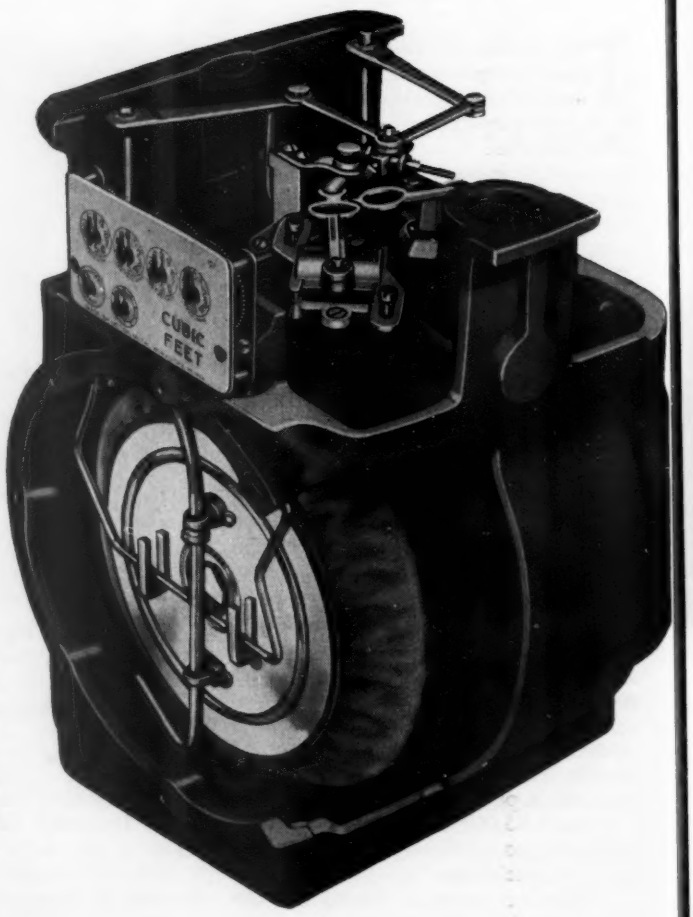
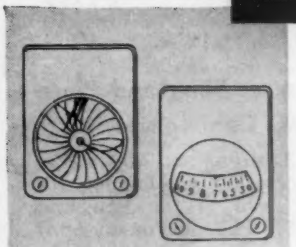
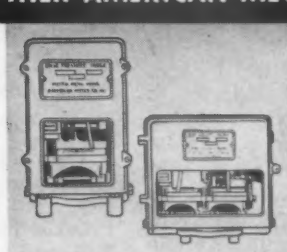


American Meter Company's century-old tradition of "*sustained accuracy at lower cost*" together with company-wide standardization, highly efficient manufacturing methods and large volume production make American Tinned Steelcase and Ironcase Meters your best value in displacement meters today.

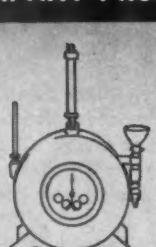
OTHER AMERICAN METER COMPANY PRODUCTS



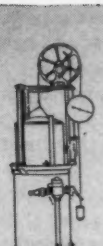
PNEUMATIC TRANSMITTERS AND RECEIVERS
(Write for Bulletin CT-49)



BASE PRESSURE AND BASE VOLUME INDEX
(Write for Bulletin E-12)



WET TEST METERS
(Write for Bulletin AG-3)



METER PROVERS
(Write for Bulletin AG-1)

DESIGN

throughout the line

Standardization upon the full-bellows type design results in "*sustained accuracy at lower cost,*" longer life, lower maintenance cost during service life of meter, and more meter value for your money.

American Tinned Steelcase and Ironcase Meters are built around this principle of standardization . . . The same "highly-perfected Glover full-bellows type two-diaphragm slide valve principle" which proved to be outstandingly accurate in the Tinned Steelcase line is duplicated in the Ironcase line.

Five large plants are constantly studying Gas Company service and operating problems — looking ahead to changing gas conditions and determining the best methods of meeting them.

Developments and improvements in one are rapidly expanded to the others. Thus, when you buy American Meter Company Tinned Steelcase or Ironcase Meters you are receiving the accumulated know-how of 114 years of experience, the lessons learned from millions of meters in service and the knowledge of the Gas Industry's needs gained by more than a century of close association with its gas measurement problems. *Write for Bulletins EG-40 showing Ironcase Meters, TG-4 showing Tinned Steelcase Meters.*

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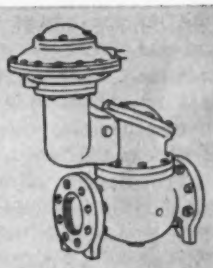
CALORIMETER
(Write for Bulletin AG-2)



CBV REGULATOR
(Write for Bulletin 50-A)

Pros—Cons Given by Investment Advisers On Natural Gas Reserves

by John F. Falvey

THOSE who guide investment thinking express sharply divergent opinions as to how far ahead natural gas pipe line companies should accumulate reserves and also as to whether the individual companies should be free to dispose of gas reserves already indicated as available for future operations and needs of the pipe line.

This cross-current of ideas is indicated in answers which the writer has obtained from leading investment advisers to questions posed by Federal Power Commissioner Nelson Lee Smith on his recent appearance as guest speaker at a forum of New York investment advisers.

"If established pipe lines are required to secure gas supplies far in advance of their substantial use, there will be extra expense which will have to be borne by the rate-payer," Commissioner Smith stated. "The essential question is, therefore," he asked, "is the insurance thus bought worth the premium?"

"I would also like to know," he said, as he pursued the subject further, "whether you think natural gas companies should be free to dispose of gas supplies which have been relied upon in certificate proceedings without securing from the commission authorization for such disposition upon a showing that this will not impair service to the public."

Approximately 75 per cent of his listeners who vouchsafed replies to these two questions unqualifiedly endorsed the procurement by pipe line companies of gas supplies far beyond their substantial use but the replies were about evenly divided on the question of the individual company being permitted to dispose of gas reserves merely on a showing by management that the step will not impair service to the public.

Procurement of gas supplies far in advance of their indicated need "is cheap insurance against future shortages" and "definitely worth the cost to the consumer to assure continued service and to the investor to insure long term value to his investment," say those who favor the proposal, while some of those opposed "do not think this equitable" but rather "favor conservation of total supply and payment of current cost by current consumers."

"Since the prime function of a utility is to provide adequate and continuous service to the public, the securing of gas supplies far in advance of their substantial use is an obvious necessity," one investment authority avers. "Since this is a necessity for the benefit of the rate payer, the extra expense should be borne by the rate payer. As to whether the insurance thus bought is worth the premium is a question which to my mind could never be answered empirically. I can conceive of conditions when continuity of adequate service could have tremendous values and other conditions under which it may not be of much importance."

While going along with this line of reasoning, another leading analyst tempers his views with the observation that the quest for additional reserves should be kept within reasonable bounds. "It seems to me that almost any rate payer would be quite willing to pay some small premium to know that his supply of natural gas would be good for as long a period ahead as any man can hope to plan for in this world. On the other hand, I do not believe that established pipe line companies should be allowed to go out prospecting on a grand scale and pile up reserves which, so far as is humanly possible to predict, would be

FPC Commissioner Smith Approves Earnings Sufficient to Get New Capital

SUPPORT came from another quarter recently upholding the regulatory principle that utility companies are entitled to rates that will not only properly service the present investment *but which also will be sufficient to attract the necessary new capital to finance expansion.* (AMERICAN GAS JOURNAL, October 1950).

"It is a truism . . . that healthy growth requires earnings adequate to attract the requisite capital," said Federal Power Commissioner Nelson Lee Smith in an address before the New York Society of Security Analysts on December 8.

"The maintenance of satisfactory earnings is, like the adaptation and timing of security offerings to meet sensitive market conditions, essentially a managerial function," he pointed out. "It is, however," he added, "the duty of the various regulatory agencies, both state and federal, to allow rate increases shown to be necessary to cover rising costs of material, labor, money or taxes as promptly as fair treatment of the rate-payer will permit.

"Present indications point to higher interest rates. . . . Significant changes in the cost of money to public utilities and in yields on comparable investments will necessarily be reflected in fair rates of return which commissions will have to allow ultimately, and should be prepared to revise promptly."

Asked whether recovery of excess profits taxes (if any) would be allowed and whether an increase in rates would be forthcoming to a utility which actually did not need the relief immediately but foresaw the contingency looming just ahead, Commissioner Smith replied in the affirmative, the latter as a general proposition.

The Federal Power Commission has allowed some rate increases against contingencies, under bond, he stated, but in some cases it has had difficulty getting the refunds back to the rate payer. On this score, he pointed out, there has been

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far in excess of any foreseeable future need of the system."

"The so-called insurance being paid by a consumer of natural gas because the distributor must contract far ahead of his requirements is not as onerous as the commissioner's question would imply," another states. "First of all, natural gas producers are many times just as interested in securing substantial contracts for a certain number of years ahead as the distributor might be, particularly where escalator provisions on the matter of price are included. A long-term contract stabilizes the producer's outlook and enables him to go ahead with more exploration and development. On the other hand, if one envisioned a major pipe line buying only 'spot' natural gas, to state an unlikely extreme, I would not be surprised to see the ultimate consumer, whether he is protected by a regulatory body or merely runs a business which is regulated by his own judgment, fare worse than under the long-term contract provision with no extra carrying charge for the greater and more continuous supply.

"There is another aspect to this question which also deserves consideration. Financing of a pipe line whether it is done by insurance companies or by other major investors is facilitated, in my opinion, by reason of the long-term contract for gas assuring supplies well into the future. Conversely, if such supplies were not contracted for, I think that the interest cost on a pipe line project would be higher and naturally the consumer would shoulder the extra expense, even though the stockholder would be hurt too."

One important investment authority holds to the opinion that the question "is loaded" to some extent by the qualifying clause "far in advance of their substantial use."

"I certainly do not believe that rate payers should be burdened with an extra expense involved in having the established pipe lines secure gas supplies far in advance of their substantial use," he holds. "Most established pipe lines have access to additional supplies as they are needed, since their sources of supply are in areas where new discoveries are continually being made. Therefore, it should not be necessary for them to make the same kind of showing with respect to gas supplies as the new pipe line companies. Generally, I think the Federal Power Commission has been right in requiring more in the way of new companies obtaining long term gas supplies than has been required of the established companies. The only question in my mind is whether the commission may have been somewhat overly zealous in requiring the new companies to show access to supplies 'far in advance of their substantial use.' "

The rapidly expanding network of pipe lines makes the question of natural gas reserves of paramount importance.

This illustration was supplied by Bechtel Corp.

Commissioner Smith himself pointed out in his talk both sides of the argument as to the question—"If a system has been in existence for some time and wants to enlarge its capacity to meet enlarged demands or to serve new markets, is a deliverability showing on an incremental basis sufficient, or should it be required to acquire additional reserves far in advance of the time when they will really be needed to render full service?"

"In support of the first alternative," he said, "it is pointed out that gas purchase contracts often contain extension options, that ordinarily they are renewable, that spot and flare gas purchases are desirable, and that pipe lines tapping given producing areas are in a particularly good position as to both contract extensions and new discoveries. For the other method it is argued that we cannot assume that services now rendered will be terminated at the end of the initial contract period while newly authorized services are continued beyond that time. Likewise, it is pointed out that, for practical reasons, market estimates are usually limited to five years ahead, whereas there is every indication that the demands of presently-served markets will continue to grow beyond that time."

"Much depends on what is meant by the word 'required,' " is the thought expressed in one investment quarters. "If the acquisition of additional gas supplies seems desirable as a matter of good business judgment for the continued success of the company's business and to assure present customers of adequate supplies of gas for a reasonable period in the future, then the extra expense involved should definitely be borne by the rate payer. . . . The important point is how many years' supply is added by the acquisition beyond the current requirement of 20 years as set up by the Federal Power Commission. If the pipe line company adds two, three or even five years' supply at a time, for the purpose of maintaining a 20 to 25 year supply in relation to current demand, it is a reasonable condition. However, if 10, 15 or 20 years' supply is added on top of a current 20 years' supply, then it would appear excessive and perhaps the additional expense should not be borne entirely by rate payers."

On this same line of reasoning two thoughts are expressed. One is that: "The matter of supply is of far greater concern to the person with money invested in the business. The assurance of

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Gas Reserves, Pipe Line Interconnections Are Matters of Import

by Thomas C. Buchanan

Vice-Chairman, Federal Power Commission

I WAS greatly interested in reading a recent address by Lyon F. Terry, vice-president of The Chase National Bank, before the American Gas Association at its Atlantic City convention. The very interesting statistics which Mr. Terry gave on the future supply of natural gas caused him to reach the conclusion that the proved reserves of 180 trillion cu. ft. had been estimated by the AGA committee with reasonable precision, but that the total future supply, including reserves yet to be discovered, cannot be accurately determined. Nevertheless, he said that if it could be shown that the future supply will not be less than a *minimum* figure, it may prove to be a useful guide to *management, consumers* and *investors.* (I could have added: and to the regulatory agencies as well.) Then Mr. Terry fixed that minimum figure at 500 trillion cu. ft. which is really astounding—a figure which in itself points the way to the necessity of having some impartial medium to constantly check new discoveries of gas in order to gauge the accuracy of the estimate for the public good.

With something of the same thought in mind, recently the commission was discussing the reserve problem with members of the staff. Commissioner Wimberly asked the question: How much of the known gas reserves are dedicated to interstate pipe lines? In a subsequent memorandum the staff reported that the question was difficult to answer because of duplications but it could give a reasonable approximation representing the reserves dedicated to the various major interstate systems.

The tabulation showed, that of the 180.4 trillion cu. ft. of known reserves, 94.4 trillion cu. ft. are dedicated to 24 major interstate pipe lines operating under certificates issued by the Federal Power Commission. This is 52.3 per cent of the total known natural gas reserves of the United States. The remaining balance of those reserves are of course dedicated, *in part,* to intrastate lines, but to what extent the staff was unable to estimate.

Paper presented at annual meeting of Independent Natural Gas Ass'n, Houston, Oct. 23, 1950.

***I am not speaking for the Commission but expressing only some thoughts entirely of my own regarding the natural gas industry.*—The Author**

Of course these figures are startling and emphasize the need for a constant and careful examination of the reserve picture not only for the benefit of the certificate requirements of the commission but likewise for the information of state commissions, investors and of the natural gas industry itself. Furthermore, it must be noted that the present mobilization effort may increase the importance of a reasonably accurate knowledge of how much and where gas reserves are available for governmental allocation to industry engaged in that effort.

Why Not a Grid?

In the same vein interconnection of pipe lines was the subject of a recent letter to the commission. It is a matter of great importance.

As a consequence of this inquiry, maps of natural gas pipe line facilities prepared by the drafting section of the commission and submitted by various companies in their applications for certificates of public convenience and necessity have been examined in an effort to determine whether or not interconnections between facilities of various companies appear desirable. This study has revealed the existence of a total of over 200 points at which such interconnections could be made, exclusive of possible interconnections in the West Virginia and Pittsburgh congested pipe line area. This number includes possible interconnections between interstate and intrastate pipe lines.

The natural gas industry has an enviable record in the operation of natural gas transmission facilities, particularly with reference to continuous service. However, in cases of national emergency, operations of saboteurs could play havoc with this record. It is well known to all those engaged in the gas industry that natural gas has a peculiar value in industrial processes which are employed in defense work.

Under such circumstances, it appears that interconnections between pipe line companies would be of extreme value in insuring continuity of service. Interconnections exist between various pipe line companies, but most of these were constructed during the initial period of growth of the long distance natural gas pipe line industry. Therefore, these interconnections exist near the sources of gas supply. With new pipe lines built during the past five years now girding the country, opportunities now exist for interconnections nearer to the principal market areas. Such interconnections would go far toward assuring adequate supplies of natural gas required in the defense effort.

While the emphasis at present is for the assurance of natural gas for industry in order to aid the defense effort, such interconnections would be of value in normal times. The tremendous growth in the use of gas for space heating purposes by the domestic consumer requires assurance of a continuous supply of natural gas to the markets. Although the record of the pipe line companies to date is indeed envious, failures have occurred. Extreme hardship has been averted only by heroic efforts and cooperation between the pipe line companies and the local distributing companies. During the period immediately following cessation of hostilities in World War II, a shortage of gas was prevalent throughout the whole of the Appalachian area. These shortages required allocations of the available supply.

In addition, in extreme emergencies supplies of natural gas normally available in one area were required to be diverted in other areas. A greater number of interconnections between various pipe line companies would have been of extreme value during that critical period.

I could proceed to a discussion of other common problems with particular emphasis on the necessity for devising methods leading to the exemption of small facilities from certificate requirements, possibly through some sensible

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NEW TEXAS-TO-CHICAGO PIPE LINE WELL UNDER WAY

THE Texas Illinois Pipeline Co. of Chicago recently received FPC authorization to increase the daily capacity of its new natural gas transmission system from 312,625,000 cu. ft. to 383, 350,-000 cu. ft.

Texas Illinois, an affiliate of The Peoples Gas Light and Coke Co., Chicago, broke ground last August, a little more than a month after the FPC granted authorization for the building of the new line.

To accomplish the new increase in capacity of the line, Texas Illinois will make certain changes in the units powering its compressor station and build approximately 72 miles of new line in Texas in order to deliver the additional gas to the system.

The FPC order authorizes Texas Illinois to sell the additional gas to some of its presently authorized customers, with 7,705,000 cu. ft. per day to be reserved pending further order of the commission upon appropriate application. Texas Illinois has indicated that it will apply for authority to serve the 7,705,-000 cu. ft. to distributors of gas along the route of its line, including the following Illinois communities, when each prospective customer is ready: Sullivan, Altamount, Carlyle, Beckemeyer, Salem, Lovington, Bement, Shattuck, Hoffman, Sandoval, and Junction City.

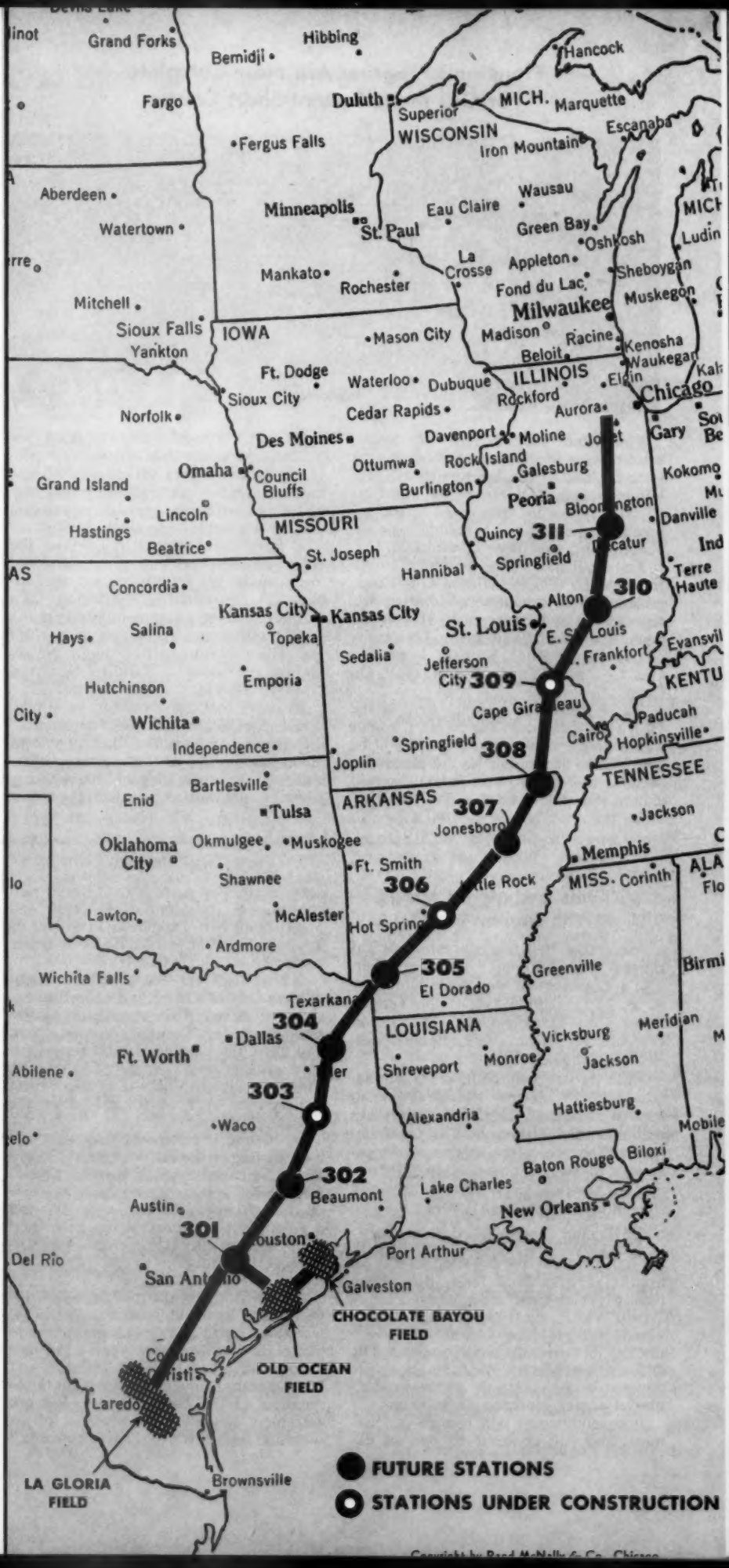
Present customers which will receive additional volumes of gas under the new authorization are: Natural Gas Pipeline Co. of America, Public Service Co. of Northern Illinois, Northern Indiana Public Service Co., The Peoples Gas Light and Coke Co., and Western United Gas and Electric Co.

Distributing companies serving communities along the route of Texas Illinois line which will receive additional daily volumes of gas are: Allied Gas Co. —Paxton Division, Monarch Gas Co.— St. Elmo and Brownstown, and Union Gas and Electric Co.—Bloomington.

Estimated cost of the new construction is $11,216,800, and estimated cost of the complete line is approximately $120,000,000.

This will be the third and biggest line built within the past 20 years for the transmission of natural gas from the Texas fields to Illinois and Indiana.

Illustration supplied by Peoples Gas News, Chicago.



Plans and Program Are Now Complete For Gas Measurement Short Course

IN THE PICTURE (ALL LEFT TO RIGHT)

First Row Seated: T. S. Whitis, James L. Griffin, Ben F. Worley, W. H. Carson, R. O. Cox.

Second Row: Roy S. Peace, Jr., Walter A. Brewster, R. R. Suttle, W. H. Woods, R. M. Scofield, K. R. Tibbets, E. L. Stark.

Third Row: T. J. Kirkpatrick, Dean Bruce, George E. Greiner, M. D. Gilbert, J. H. Satterwhite, George H. Smith, Charles A. Breitung.

Plans and program for the Southwestern Gas Measurement Short Course —to be held at the University of Oklahoma, Norman, Oklahoma, on April 10, 11, and 12—were completed at the fall meeting attended by 19 members of the general and executive committees.

The chairman of the general committee, Ben F. Worley, United Gas Corp., presided. The executive committee was represented by Chairman W. H. Carson, dean, College of Engineering, University of Oklahoma; R. M. Scofield, Lone Star Gas Co., and W. H. Woods, Gulf Oil Corp.

All sessions will again be held at the Drill Hall located on the North Campus where ample facilities and space will be provided to accommodate the classroom sessions and the 30 odd firms who will exhibit equipment used in the measurement and the regulation of natural gas.

The committee has planned a program which covers all phases of gas measurement work including gas accounting, metering, pressure regulation and instrumentation. The instructors who have been invited to conduct the classroom sessions and give individual instructions are authorities on the application, installation, servicing and maintenance of equipment used in the measurement and regulation of natural gas. The program will be under the direction of James L. Griffin, Northern Natural Gas Co., Omaha, Nebraska.

In order that the exhibitors of educational equipment will be represented, the general committee has approved recommendations of the executive committee for the formation of an exhibitors advisory committee consisting of five members to be elected by representatives of the firms who exhibit educational equipment at the Short Course.

The general committee has also approved a reorganization plan creating the office of vice-chairman for the publications and exhibits committees.

New members elected to the general committee were Gordon B. Gudger, Gulf Refining Co., Houston, representing the south Texas area and replacing W. H. Woods, Gulf Oil Corp., Houston, who served as general chairman for the 1950 Short Course and is now a member of the executive committee; C. A. Breitung, gas supervisor, Railroad Commission of Texas, and Elmer Capshaw, gas engineer, Oklahoma Corporation Commission, representing two of the commissions who are sponsors of the Short Course.

O'Keefe and Merritt Merge With Tappan Stove

Merger of two manufacturers of gas ranges was completed in December. The announcement was made jointly by A. P. Tappan, President of the Tappan Stove Co., Mansfield, O., and D. P. O'Keefe, President of O'Keefe and Merritt, Los Angeles.

Officials of both companies emphasized that the merger would not result in any change in personnel or present methods of distribution. The chief immediate benefit of the merger is the exchange of engineering and manufacturing information since there is not any substantial competition between the two companies.

The combined engineering and production facilities are expected to play an important role in defense production during the current emergency. During World War II, the Tappan plant was devoted 100 per cent to war work, primarily in aircraft components. The O'Keefe and Merritt plant facilities were devoted in their entirety to the production of power generating equipment.

Both companies will remain autonomous and will continue to operate exactly as in the past. Mr. O'Keefe will continue as President of O'Keefe and Merritt and Mr. Tappan as President of Tappan. No change of officers of either company is anticipated.

It was disclosed that all of the shareholders of O'Keefe and Merritt exchanged all of their outstanding common stock for Tappan common stock and cash, the combined total representing a value of approximately $5,000,000. This is believed to be one of the largest transactions ever consummated in the gas range industry.

In issuing a statement following the final signing of the contract, Mr. O'Keefe said: "We are happy to become associated with Tappan, particularly because of the extensive Tappan research and development program. When combined with our own effort, this should result in a great contribution to the gas industry."

Commenting on the merger, Mr. Tappan said: "In the interest of expansion, we have studied a great many range plants in the last few years. We are firmly convinced that the O'Keefe and Merritt plant is one of the finest gas range factories in the United States. We are extremely pleased at the prospect of association with this progressive concern."

Hiram Burrell Hardwick Dies Of Heart Attack

Hiram Burrell Hardwick, formerly of New York City, comptroller and director of Consumers Power Co. died of a heart attack at his home in Jackson, Mich., December 27.

Mr. Hardwick was a leader in public utility affairs in New York City, Birmingham, Alabama and in Michigan. His utility career began in 1918 with Alabama Power Co., and in 1925 he came to New York with Southeastern Power & Light Co., one of the predecessor companies forming The Commonwealth & Southern Corp. of which he was assistant comptroller from 1930 until 1947. He was elected comptroller of Consumers Power Co. in 1947 and elected to the board of directors in 1949.

Mr. Hardwick was a member of the Controllers Institute of America and of the New York Society of Security Analysts and was also active in the affairs of the Edison Electric Institute and the American Gas Association.

Mr. Hardwick was born in Easonville, Alabama, in 1898 and attended Alabama Polytechnic Institute at Auburn.

Courts Decide Rights and Wrongs Of Rate Regulation

by Leo T. Parker
Attorney at Law, Cincinnati

NUMEROUS gas corporation officials and employes have expressed a desire for information concerning the outcome of recent higher court decisions involving validity of new and increased gas rates, and other law suits pertaining to new gas rates. Hence, this article is a review of these decisions.

First, it is important to know that modern higher courts consistently hold that a fundamental principle of gas rate regulation by the Public Service Commission is that the rate established must be sufficient to yield a fair return on the reasonable value of the property used, or invested, for doing the business after paying costs and carrying charges. Rates not sufficient to yield such return are unjust, unreasonable and confiscatory.

For example, in Lowell Gas Co. v. Department of Public Utilities, 84 N. E. (2d) 811, a gas corporation contested new gas rates established by the Public Service Commission were unreasonable and confiscatory. The court held that the state must provide a *fair opportunity* for submitting the gas corporation's contentions to a judicial tribunal for determination upon its own independent judgment, otherwise the order of the Public Service Commission is void. This court said:

"It must, therefore, be taken to be the law that the Declaration of Rights guarantees to an owner (gas corporation), who alleges that confiscation of property will result from a rate order of the department, a fair opportunity for submitting that issue to a court for determination upon its own independent judgment."

This court also held that the income received by the gas company from merchandise and jobbing business conducted by the company was *not* to be included in the company's income for the purpose of rate making.

The testimony showed that exclusive of profits derived from selling merchandise, appliances, etc., the income yield on the basis of the new rates established by the Public Service Commission would allow a return of less than 2.5 per cent on the corporation's investment.

The higher court held the new rates confiscatory and void, saying:

"Irrespective of whether the earnings permitted by the order were proportional to any rate base, whatever may have been the theory upon which such rate base was determined, the order of the department (Public Service Commission) is confiscatory."

6.44% Is Reasonable

According to a recent higher court a new gas rate order established by a Public Service Commission based on 6.44 per cent yield on the corporation's stated investment and 4.3 per cent on the corporation's investment as appraised by the city is valid and reasonable.

For example, in City of Cincinnati v. Public Utilities Commission, 86 N. E. (2d) 10, the testimony showed facts, as follows: The council of a city by ordinance and pursuant to the provisions of a state law established new gas rates. The gas company was not satisfied with the new rates contending that in view of higher costs, and valuation of its properties, the allowable rates should be higher. The gas company appealed to the Public Service Commission which allowed an increase of rates, using as a basis the valuation of the gas company's properties which would yield the company an income of 6.44 per cent, and on the basis established by the city 4.3 per cent. The city appealed to the court which approved the rate established by the commission and said:

"We are of the opinion that the order of the commission was not unreasonable or unlawful to the extent that it determined that a rate of return of 6.44 per cent for the gas company was not unjust or unreasonable so far as customers of the gas company were concerned and did not provide the gas company with more than reasonable compensation."

Also, this court disregarded a complaint filed by the city about the commission's allowance, as part of the cost of service, of charitable contributions of $4,245.83 and association dues of $1,826.08 for the year.

The court said: "Even if we were to decide that these charitable contributions, association dues, and other small items should not have been allowed as a part of the cost of service, the city would not be enabled to sustain the burden which it has in this court of showing that the rates fixed by the commission were unjust or unreasonable."

Also, the city contended it was improper to allow and approve a charge of $20,315.51 to operating expenses a single year as expenses for maintenance of customer appliances. The court held this expense valid and said:

"There was evidence in the record supporting the conclusion that this sum related to "turning appliances off during the summer and on in the winter and . . . inspecting the appliances' and was 'available to all customers'. The expense of such service would be allowable as a part of the gas company's cost of furnishing its public-utility service."

And again the court refused to consider favorably the city's complaint that the commission should have disallowed the $8,901.07 cost in 1946 of "stock registrar services, stock transfer agent and disbursing agent services, trustee service and expenses and the printing of reports to stockholders".

The city argued that payments for these items constituted payments by the gas company *for the benefit* of its shareholders and had nothing whatever to do with the furnishing of gas service to consumers. The court held that these items are valid expenses, saying:

"The business of supplying gas to a city the size of Cincinnati must normally be conducted by a corporation. It is practically impossible to conceive of an individual or a partnership engaging in such a business because of the amount of capital required and the risk that is inherent in the very nature of the business. A corporation naturally has certain expenses in connection with it. In the attraction of capital to such an enterprise, expenses for stock registrars, transfer agent for stock, trustees' fees in connection with mortgages, and reports to shareholders are unavoidably incurred.

This being so, these expenses are necessarily incident to the supplying of gas to consumers and hence were properly allowed by the commission."

Validity of Franchise

Considerable discussion has arisen from time to time over the legal question: Is a contract or franchise between a city and gas corporation valid which states that *before* applying to the Public Service Commission to increase present gas rates, the city and gas corporation must make a *bona fide* attempt to agree upon new rates? According to a recent higher court the answer is "yes."

Also, this court held that although state laws do not *directly* confer upon municipalities the power to make valid rate contracts with gas corporations, yet the city has the implied power to make such valid contracts if the state constitution contains a clause that the gas corporation cannot use the streets for installation and maintenance of gas mains, accessories, etc., without consent of the city.

For example, in City of Mt. Pleasant v. Michigan Consolidated Gas Co., 39 N. W. (2d) 49, a gas franchise was litigated which provides in the event that the gas corporation and the city commission or authorities cannot agree to a new gas rate then either party *may* apply to the state public service commission to fix and establish new rates.

It was contended by the gas corporation's counsel that this franchise clause did not under all circumstances obligate the corporation to consult with city authorities before appealing to the Public Service Commission, but the higher court decided otherwise.

The facts are that in 1934 the city and gas corporation negotiated for the adjustment of new rates. At this time the parties were unable to agree, and the city petitioned the Public Service Commission for an order fixing and determining rates. The commission acted on the petition and in 1935 established new gas rates. A few months ago the gas corporation desired to increase its rates and instead of consulting with the city authorities it immediately filed a petition with the Public Service Commission. It was the contention of the gas corporation's officials that since the jurisdiction of the commission was invoked and exercised previously, the clause of the franchise with reference to fixing rates by agreement with the city officials was abrogated, and that exclusive power to alter the rates was thenceforth vested absolutely in the Public Service Commission.

The higher court refused to agree with this contention, saying:

"Under the provisions of the franchise it was the duty of the defendant (gas corporation), before invoking action by the Public Service Commission, to endeavor in good faith to reach an agreement with plaintiff city with reference to proposed alterations in the rate schedules. This it did not do. . . . It may be assumed that the parties had in mind in the framing and acceptance of the franchise that changes in the rate schedules would, from time to time, become necessary. From the language used it seems evident that the parties intended that in each instance of a desired alteration such action should be taken, if possible, with the mutual consent of the city and the utility. Recourse to the state commission was authorized only in the event of failure to reach an agreement."

Power to Contract

Another argument presented by counsel for the gas corporation was that under no circumstance may a city and a gas company make a valid contract for gas rates, unless such contract is approved by the Public Service Commission, or unless a state law clearly authorizes the city to make such a contract.

The court decided that a city may make valid contracts, under direct or implied authority of the state's constitution, although it is not authorized to do so by the state's statutes.

Also, see City of Detroit v. Michigan Public Utilities Commission, 288 Mich. 267. In discussing the right of a municipality to contract, the court explained that since the state constitution provides that no corporation operating a public utility shall have the right to the use of the highways, streets, alleys without the consent of the duly constituted authorities of such city, it may be implied that a city can make a valid contract as to rates to be charged by a public utility. This court said:

"Under the above provision of the constitution, the city has the power to fix reasonable rates as a condition to the use of its streets by a public utility."

And again in City of Noblesville v. Noblesville Gas & Improvement Co., 157 Ind. 162, the court stated:

"That the city had no power to regulate the rates of its licensee makes no difference. It had the power to contract. And the power to regulate as a governmental function, and the power to contract for the same end, are quite different things. In this instance the city acted in the exercise of its power to contract, and it is therefore entitled to the benefits of its bargain."

And in the City of St. Mary's v. Hope Natural Gas Co., 71 W.Va. 76, it was held that the city might, in the control of the use of its streets, prescribe conditions including the fixing of rates for gas, and might contract therefor, even though it possessed no governmental power to fix rates.

The distinction between fixing rates by contract and under governmental power was clearly recognized by the Supreme Court of the United States in the case of City of Detroit v. Detroit Citizens' St. Ry. Co., 184 U.S. 368. Here the court said:

"It is plain that the legislature regarded the fixing of the rate as a subject for agreement between the parties and not as an exercise of a governmental function of a legislative character by the city authorities under a delegated power from the legislature."

And again in Boerth v. Detroit City Gas Co., 152 Mich., 654, 18 L.R.A., N.S., 1197, the gas corporation contended that the city had no power to regulate gas rates either by contract or legislation. It was held, however, that while the city had no legislative power to contract or establish rates, it had the *implied* power to prescribe rates by agreement, as a condition to the use of its streets by the gas company, because of the control provided for by the constitution.

Distribution of Accumulated Fund

Considerable discussion has arisen from time to time over the legal question: If a fund is accumulated during court procedure to determine whether lower rates established by a commission is valid, who shall receive the fund in event the court upholds the validity of the lower rates? According to a recent higher court only retail consumers of gas are entitled to distribution of the accumulated fund.

For illustration, in Citizens Utilities Co. v. City of La Junta, 215 Pac. (2d) 332, it was shown that the Citizens Utilities Co. operates plants for the distribution of natural gas *at retail* to consumers in the city of La Junta and surrounding municipalities. The retail rate charged for gas had been established by the power commission. The Citizens Utilities Co. purchased the gas at wholesale from Colorado Interstate Gas Co., and the retail rates paid by the customers of the Citizens Utilities Co. were based upon rates paid to the Interstate Co.

As a result of legal proceedings before the Federal Power Commission, the Interstate Co. was ordered to reduce its wholesale rates to the Citizens Utilities Co. Interstate sued to obtain a stay of the FPC order reducing the wholesale rates and permitting the use of the old rates on condition that the Interstate deposit with the court, out of wholesale charges collected, the difference between the rates then charged and the lower rates prescribed by the commission. During the pendency of said appeal in the lower courts and in the United States Supreme Court there accumulated in the

(Continued on page 41)

Index of Yields : Selected Utilities Stocks

	Dec. 1950	Nov. 1950	Oct. 1950	Sept. 1950	Aug. 1950	July 1950	June 1950	May 1950	Apr. 1950	Mar. 1950	Feb. 1950	Jan. 1950
Natural Gas Transmission Companies	5.97%	5.62%	5.19%	5.71%	5.46%	5.76%	4.86%	4.70%	4.77%	4.57%	4.83%	5.02%
Natural Gas Transmission & Distribution Companies	5.67	5.46	5.40	5.61	5.71	5.79	5.29	5.11	5.14	5.19	5.26	5.23
Manufacture & Mixed Gas Companies	5.56	5.46	5.24	5.52	5.55	5.76	4.98	4.66	4.77	4.71	4.75	4.62
Class "A" Electric Companies	6.19	6.03	5.56	5.67	5.59	5.64	4.94	5.13	5.24	5.15	5.38	5.40
Class "B" Electric Companies	6.38	6.06	5.99	6.06	6.35	6.41	5.58	5.30	5.37	5.42	5.37	5.47

Method of Compiling Index of Yields

This is a straight arithmetical index of comparative yields obtainable on a selected group of gas and electric utility industry common stocks.

The companies comprising this index have been selected by the AMERICAN GAS JOURNAL as providing a representative cross-section of each industry, from the standpoint of geographical diversification and of the relative importance of the individual companies in their areas.

No effort has been made to weight the average to give effect to changes in capitalization or in dividend rates because the yields afforded on the issues reflect such changes. The index is designed to show the rate of return and not necessarily market movements on the stocks comprising it.

The companies used in compiling this index are:

Natural Gas Transmission Companies: El Paso Natural Gas Co.; Northern Natural Gas Co.; Panhandle Eastern Pipe Line Co.; Southern Natural Gas Co.; Tennessee Gas Transmission Co.

Natural Gas Transmission and Distribution Companies: Columbia Gas System, Inc.; Consolidated Natural Gas Co.; Lone Star Gas Co.; Oklahoma Natural Gas Co.; Pacific Lighting Corp.

Manufactured and Mixed Gas Companies: Bridgeport Gas Light Co.; Brooklyn Union Gas Co.; United Gas Improvement Co.; Peoples Gas Light & Coke Co.

Class "A" Electric Companies: Boston Edison Co.; Commonwealth Edison Co.; Houston Lighting & Power Co.; Southern California Edison Co., Ltd.

Class "B" Electric Companies: Dayton Power & Light Co.; Hartford Electric Light Co.; Pennsylvania Power & Light Co.; Public Service Co. of Colorado; San Diego Gas & Electric Co.

1951 Will Be a Year of Continuing Problems

John F. Falvey

GAS company managements can look forward to further worries as they cross the threshold to the latter half of the 20th century.

Whereas the accent a year ago at this time was on the problem of raising new expansion money on an advantageous price basis, the hurdle now is a sharply rising cost and tax burden.

No basis obtains for measuring either accurately at the moment; but while they may not be insurmountable, they certainly will be burdensome.

Even those who specialize in utility industry securities do not see eye to eye on possible developments. Some consider the gas and electric company stocks more promisingly situated now than they were a year ago. There reasoning: A utility stock is one to be bought for yield. They were capitalized too high before and yielding only about 5½ per cent on the average. Now they are selling too low to yield around 7 per cent.

"Anything is attractive at a price," this segment of the investment field reasons.

As further argument to augment the promising yields, they stress that whereas a business decline might have been in the cards a year ago, there is none in sight now, and that prospective shortages of materials will mean less financing need than heretofore has been indicated.

On the other side of the investment fraternity fence are the erstwhile optimists who now look for possibly only a rally in utility stock prices, and not for a full fledged recovery—and with definitely lower market quotations in view over the next year to 18 months.

Their reason: A very difficult cost squeeze and no way for the utilities to offset it.

These observers expect a good utility market for the first half of 1951, if Congress puts off the tax burden until the latter half of the year.

One point prevails, however, on which all interested parties seem to be in agreement—that the normal and surtax federal rate will be 50 per cent. To consider less would be foolhardy, they reason, and there are many in the industry who nod agreement.

While the slow manner in which the indicated tax rate recently has been slipping upward might have lulled some to sleep over its implications, the impact is heavy and will become increasingly so at a 50 per cent rate—which would be an increase of 32 per cent in the course of only a year.

Comments on Yield Table

Utility stock issues are becoming "orphans of the storm" as investors scramble headlong for shares of a war baby character, such as oil, steel, rubber and similarly situated industries.

Under the stimulus of heavy buying which brought stock purchases to date this year to nearly double the volume for the identical 1949 period, average stock prices have reached a new high mark since 1931.

Utility shares have been lost in the shuffle and have followed a horizontal price pattern.

The buying—as in previous war scare periods—has not been dictated by reason but has been in complete disregard of the possibility that imposition of Federal Government controls—such as hit the automobile industry—may adversely affect corporate profits through price roll-backs and consequent forestalling of management efforts to pass on to consumers higher costs and taxes.

The situation presumably may right itself but the process in all likelihood might take a few months. Meanwhile, the fundamental position of the market continues satisfactory, in the opinion of qualified observers.

Thanks to small concessions in a couple of cases to increase yields slightly, the recent offerings of new corporate bonds have been practically cleared away and the investment banking firms await with clean shelves whatever the New Year may bring in the way of corporate offerings.

There is one serious fly in the ointment for them, however, and that is the sharply increasing proportion of new securities which has been going into institutional channels of late without entering the process of competitive bidding or other investment firm procedures.

According to a compilation made

recently by the industrial securities committee of the Investment Bankers Association, institutional investors in the first nine months of 1950 took through private deals $829 million of the $1,331 million new corporate offerings which came along during that period.

The committee predicted in its report to the association that the trend away from public offerings by corporations in favor of private deals with institutions will be further accelerated by uncertainties in the tax outlook. In the committee's own words: "The impact and uncertainty of higher taxes may, despite Government urging, delay many large scale expansion plans being put into effect. Higher taxes will increase the volume of debt financing for this purpose and further accentuate the private placement trend."

Texas Gives Accredited Degree For Natural Gas Engineering

The Natural Gas Engineering curriculum at the Texas College of Arts and Industries, Kingsville, Texas, has been accredited by the Engineers Council for Professional Development. The accredited degree will read "A Bachelor of Science Degree in Petroleum and Natural Gas Engineering." This degree was so designed because the accreditation committee does not wish to recognize too many specialized fields, although the work at A & I College is primarily designed to train students for the natural gas field.

Texas A & I and the Pennsylvania State College are the only schools in the nation offering such accredited courses.

A goal long sought for by the college and industry representatives has thus been achieved.

The original industry committee which designed the course was led by Frank C. Smith, of Houston, Texas, chairman. Other members of the Natural Gas Advisory Committee were: R. H. Hurd, Del Rio, Texas; F. Y. Hutchison, Houston; J. V. Strange, Houston; T. E. Swigart, Houston; Chester L. May, Dallas; E. Holley Poe, New York; R. E. Wartz, Amarillo, Texas; A. E. Higgins, Pittsburgh; C. H. Zachry, Dallas.

A & I students have modern and completely equipped laboratories for their work, these to a great extent having been made possible by gifts from industry.

The accreditation will mean that A & I graduates in natural gas engineering will be fully recognized in all states, and can better meet requirements for receiving state professional engineers' licenses.

Natural gas engineering was added to the A & I curriculum in 1935 and the first class graduated in 1938. Since that time 150 students have completed the four and one half year course. Dr. Frank H. Dotterweich is Director of the Division of Engineering at Texas College of Arts and Industries.

Supreme Court Upholds State Right to Fix Minimum Price of Gas at Wellhead

The U.S. Supreme Court on Dec. 11 upheld Oklahoma's right to fix a minimum price for natural gas taken from the Guymon-Hugoton field in Texas County, Okla.

Justice Tom C. Clark delivered two opinions for the majority. The court's vote was 8-1 with Justice Hugo L. Black favoring dismissal of the appeal on the ground that no substantial Federal constitutional question was involved.

A 1946 state regulation fixed gas price at the wellhead at not less than seven cents a thousand cu. ft. Previously the price was 3.6 to five cents.

Oklahoma said the regulation was intended to prevent waste and to protect rights of the public and of those having a right to produce from a common source within the state.

The regulation was attacked by the Phillips Petroleum Co., a natural gas producer, on the ground that it violated the Federal Constitution's requirement of due process of law. Phillips appealed from a decision by the Oklahoma Supreme Court, which upheld the regulation.

A companion appeal was filed by the Cities Service Gas Co., which, in addition to objecting to the seven cent minimum, protested against a state order requiring it to take gas from wells of the Peerless Oil and Gas Co.

Justice Clark said for the majority that, "like any other regulation, a price-fixing order is lawful if substantially related to a legitimate end sought to be attained."

In these cases, Justice Clark said, there was ample evidence to sustain the finding of the Oklahoma Corporation Commission that low field prices caused waste.

As to the Cities Service complaint on taking gas from wells of another company, Justice Clark said: "In a field which constitutes a common reservoir of gas, the (state) commission must be able to regulate the operations of all producers or there is little point in regulating any."

Although the FPC was not a party to this decision, commission counsel followed its progress closely because of the interest which the FPC has taken in natural gas conservation. Discussing the relative state and national interest in this subject, the court's opinion by Justice Clark stated: ". . . we cannot say that there is a clear national interest so harmed that the state price-fixing orders here employed fall within the ban of the Commerce Clause. . . . Nor is it for us to consider whether Oklahoma's unilateral efforts . . . will be fully effective."

Some members of Congress hailed the court's decision as a brake on any ambitions the FPC may have to regulate gas production through price fixing. Senator Kerr said the Supreme Court's action will "definitely extract some of the confiscation fangs of those in the FPC who would seek to force the states in the southwest, including Oklahoma, to sit idly by, while one of their most valuable natural resources is taken from them without any compensation whatever." He pointed especially to the following statement in the Court's opinion: "The price regulation applies to all gas taken from the field, whether destined for interstate or intrastate consumers." In a companion case (Phillips Petroleum Co.), the Court stressed that the state commission "must be able to regulate the operations of all producers. . . ."

Oklahoma Conservation Director States Position of Commission

In a letter to the Hon. Reford Bond, Chairman of the Oklahoma Corporation Commission, dated December 12, 1950, Financial Editor Falvey asked the following questions:

1. "Will you please advise me whether the seven cents per Mcf price set as a minimum at the wellhead for natural gas in the Guymon-Hugoton field will apply only to new contracts, or is it to be retroactive to a certain date on all contracts now in being?"
2. "Has your commission extended this seven cent price to all fields in the state of Oklahoma, or will this step now follow merely as a matter of course?"

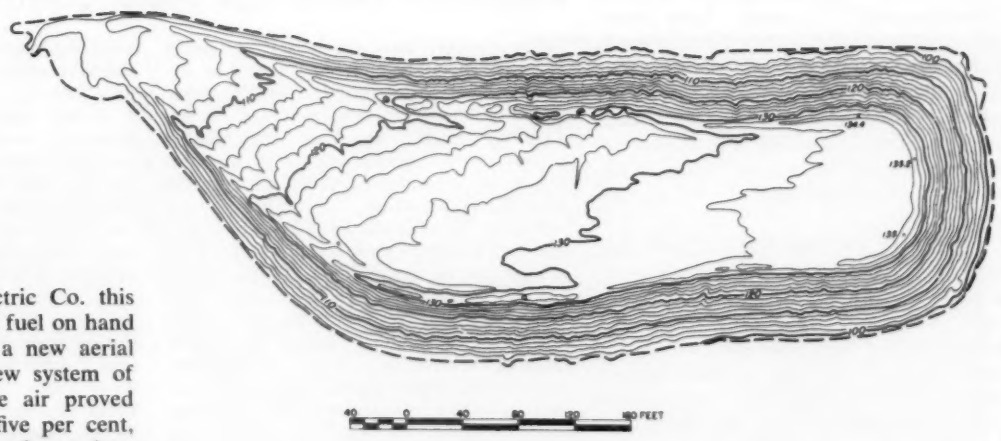
A letter was received in reply, dated December 18, 1950, signed by Walker T. Pound, director of conservation for the Oklahoma Corporation Commission. He wrote:

"It will be the position of this department that since the Supreme Court of the United States has affirmed the order of the Oklahoma Corporation Commission, fixing the field price of gas in the Guymon-Hugoton gas field, the effective date of such price will be the date of the orders of this commission. Some of the purchasers in the field, I understand, have been impounding certain moneys in anticipation of making payment for gas retroactive to the date of commission order. However, other purchasers filed supersedeas bonds at the time of the appeal from the order.

"As to extending the seven cent price to all fields in Oklahoma, this action would require another hearing, and I am sure that each field would probably consider it as an individual problem."

Airplane Pictures Cut Cost 25% In Making Coal Inventory

Two aerial photographs, overlapping 55 per cent, produced this third dimension view of the coal stockpile at Petty's Island.



This contour map was traced from the picture above with stereo-plotting instruments.

PHILADELPHIA Electric Co. this year took stock of its fuel on hand through the use of a new aerial mapping method. This new system of taking invertory from the air proved accurate within three to five per cent, and provided the inventory figures in a matter of days instead of weeks. The air survey cut inventory costs by 25 per cent.

The company's total coal stock is more than 500,000 tons, which is stored in 10 different locations. Some of the stockpiles are as large as 85,000 tons.

Up to the present time the company has carried a stock of coal gas amounting to approximately 40,000 to 45,000 tons. It is expected that this reserve will be continued regardless of the expanded use of natural gas planned later this year.

Until this year the company had used survey methods on the ground to determine the contour and volume of coal piles. This conventional method required 225 man days and interrupted the regular work of the surveyors during the period of the inventory. Because some stockpiles took several days to survey, additions or withdrawals from the piles changed the volumes and made difficult corrections necessary.

Philadelphia Electric knew that aerial mapping had been used successfully for reservoir studies, for locating transmission line surveys, and for distribution maps. Why not use it to check coal stocks?

Accordingly, the utility asked Aero Service Corp. of Philadelphia to look at costs and time schedules. It was determined a pair of aerial photos would provide the coverage needed for each site, and that the necessary photo-flights could be executed in a few hours.

Ground control required four elevation points and two horizontal points for each location. Compilation of the topographic maps with precise optical machines would require a week or ten days after photography and field control were completed.

After careful consideration of aerial inventory, the company approved the project, and the photo-flight was scheduled for the next clear mapping day. On

Samples of coal from the stockpile are weighed to convert pile volume to tons.

the day of the flight, the utility's personnel were notified to be on watch for the survey plane, so that the exact time the inventory photos were made could be recorded, an important factor in later computations. The plane flew over at an altitude of 1,200 feet.

The aerial mapping company's field survey crews next established the elevation and the distance between four fixed datum points to serve as ground controls. These points are permanent and can be used for subsequent surveys.

Each 9 by 9-inch aerial view covered approximately 75 acres. They were photographed as overlapping stereopairs, which enabled mapping compilers to trace the contours for each stockpile with the aid of a special stereo-plotting machine. In this way, a three-dimensional view of the terrain is obtained, and the contour at each height can be plotted fully.

After this plotting is completed, the area for each contour is measured with a polar planimeter. With these data the cubic volume for each "layer" or segment of the pile can be computed. The total volume is the sum of these layers. Since computation is made from peak to base in sequence, it is self-correcting, and the total possible error for each pile is within three to five per cent.

The aerial photos, contour maps, and the results of the computations for each stockpile were delivered to Philadelphia Electric Co., and to establish the tonnage for each pile, the company determined the unit weight of the coal by sampling.

Costs for this work vary according to the size of the areas to be mapped, locations, airport facilities, scheduling, and other factors. Even when mapping only a few stockpiles, some savings will be possible. The mappers also point out that speed and accuracy are always an advantage of aerial inventories. Moreover, air surveys also release many engineering man-hours for other essential work.

Westchester Is a Good Place to Live According to Westchester Lighting

THE Westchester Lighting Co., Mt. Vernon, N. Y., recently celebrated its 50th anniversary with the publication of "Westchester, a Good Place to Live, to Work, to Play." This 100 page book contains the history, scenic photographs, and interesting facts about each of the 44 municipalities in Westchester county and about the company itself.

The book was published as a public service. William F. Stevens, advertising manager, Westchester Lighting, said: "We are presenting a copy to all local school and public libraries, chambers of commerce, boards of trade, newspapers, magazines, service clubs, historical societies, and public officials. Each of our 2700 employees has received a book."

A letter by E. P. Prezzano, President, Westchester Lighting, on page one of the book tells how the idea for the publication was conceived. A series of "Know Your County" radio programs was inaugurated last October by Westchester Lighting on which representatives of the various municipalities appeared as guests.

"So much interesting information concerning the various municipalities was developed in the course of these interviews that we decided to make digests of them and to publish them on the occasion of the fiftieth anniversary of the organization of the Westchester Lighting Co.," the letter said.

In 1900 eleven small companies serving the county merged to form Westchester Lighting. Four years later Consolidated Gas Co. of New York (now Consolidated Edison Co. of New York) acquired control of the new organization, making available its "financial resources and technical skills and aiding greatly in the development of gas service in the county."

Each of Westchester's 44 municipalities has a chapter of its own in the book, telling the local history from the Revolution, through the days of Washington Irving, to the present.

Research Develops New Combustion Method

An entirely new method of burning natural gas and other city gases in industry through application of the principles of jet propulsion to stationary industrial heating, has been brought to an advanced experimental stage, according to an announcement by the American Gas Association.

Under the Association's industrial gas research program experiments have been developed for the gas industry by which gas has been burned by means of "detonation combustion" at such rapid rates that heat can be produced in a steel melting furnace or a heat treating furnace many times faster than even the most modern equipment can produce today. Experts declare that the principle of detonation combustion could aid greatly in expediting war production in fields where great industrial furnaces are used.

Detonation combustion is achieved through a rapid series of instantaneous explosions, each of which resembles the terrific explosions that jet-propel a rocket hundreds of miles into the air. By concentrating the heat of almost instantaneously consecutive explosions into a furnace, melter or other industrial heating apparatus, the capacity of that apparatus to produce is enlarged many times, according to Dr. John J. Durin, head of the Physics Dept., University of Toledo, who is consultant on this development sponsored by the American Gas Association at the Surface Combustion Laboratory, Toledo. Engineers are studying methods for further improving detonation combustion and means of applying it.

It has reached its greatest development in military science in the propulsion of rockets and planes at incredible speeds. Gas turbines also make use of this principle of rapid releases of tremendous heat jets in small confines. No such heat release rates have ever been attained in stationary industrial heating.

Research sponsored by the gas industry indicated that through the detonation combustion method heat releases and temperatures may be attained in a given space that are one-hundred to two-hundred times faster and greater than those possible under present combustion methods. Experimental detonation burners known as "resonant rotary port burners" have been built to interpret and produce these high heat releases. Resonant rotary port burners in their present stage are a development of the AGA industrial gas research program.

The ability to multiply so tremendously, the amount of heat injected into the given area of a furnace interior could have an important effect on industry, particularly at a time like this when armament and military supplies must be produced faster than ever before in history. Steel could be melted in open hearth furnaces at unbelievable rates of speed. Other heavy industrial operations could be similarly expedited, with almost unlimited heat possibilities to work with.

R. W. Otto, of Laclede, Heads AGA Convention Committee

R. W. Otto

Robert W. Otto, President, Laclede Gas Co., St. Louis, has been appointed chairman of the general convention committee for the 1951 convention of the American Gas Association, according to an announcement by D. A. Hulcy, AGA President.

Members of the committee are: R. R. Blackburn, vice-president and secretary, Southern California Gas Co.; Joseph Bowes, President, Oklahoma Natural Gas Co.; Dudley B. W. Brown, executive vice-president, Milwaukee Gas Light Co.; A. W. Conover, President, Equitable Gas Co.; John A. Fry, President, Detroit Michigan Stove Co.; J. F. Merriam, President, Northern Natural Gas Co.; F. X. Mettenet, vice-president, The Peoples Gas Light and Coke Co.; J. J. Quinn, vice-president, Boston Consolidated Gas Co., and George E. Whitwell, vice-president, Philadelphia Electric Co.

Mr. Otto will call a meeting of the general convention committee in St. Louis in January when working plans for the convention will be formulated.

Mr. Otto, a director of the association, has pledged full cooperation of the Laclede Gas Co. in helping to make the 1951 convention successful. To this end he has appointed a local committee to assist actively in the planning and conduct of the convention. The local committee is comprised of the following executives of Laclede; George Shields, chairman; Henry A. Eddins, Lovett C. Peters, Alfred Hirsh, Munroe Roberts and Raymond J. Vandagriff.

Texas Eastern Finances For Expansion

Public offering of 200,000 shares of Texas Eastern Transmission Corporation new preferred stock, 4.50 per cent convertible series of $100 par value was made on Dec. 6 by an investment banking group headed by Dillon, Read & Co. Inc. The stock was priced at $100 per share plus accrued dividends.

Each share of the convertible series is convertible at the option of the holder at any time prior to December 1, 1960 into common stock of the company at $20 per share of common stock, taking the convertible series at $100 per share.

Proceeds of the sale are to be used in connection with the company's expansion program. This program includes the Oakford storage project, recently authorized by the Federal Power Commission, for the development of underground natural gas storage facilities in Westmoreland County, Pennsylvania. It also includes the New England project, the principal part of which will involve construction of a 30 inch pipe line extending from a point near Kosciusko, Mississippi, to a company station at Connellsville, Pennsylvania, a distance of about 790 miles.

Texas Eastern has pending an application for a certificate for the New England project. Connection is planned between the New England project line and a proposed pipe line system, to be built by Algonquin Gas Transmission Co., which will serve a part of the New England area.

Texas Eastern's share of the Oakford storage project is estimated at $15,100,000 and it is estimated that the New England project will cost approximately $99,200,000.

Daily delivery capacity of the Texas Eastern system will be increased by approximately 476 million cu. ft. upon completion of the proposed new facilities.

Nordheim Is Distribution Head At Consumer's Lansing Div.

Henry A. Nordheim, former gas distribution superintendent in Consumers Power Company's Owosso Division, has been advanced to similar work in the Lansing Division in charge of distribution operations at Ionia.

Daniel

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News of the Gas Industry

Consumers Power Re-Organizes Its Pontiac Division

As part of its program of streamlining natural gas operations, Michigan Consumers Power Company has re-organized the former Pontiac Division into the new Southeastern Division, it was announced by President Justin R. Whiting.

This is the largest gas service division in the company's system and includes 105,817 of the company's more than 300,000 gas customers and extends to the Detroit City limits at many points. The new division is operated in four districts, each of which functions as a self-contained operating unit with distribution, engineering and sales departments. District offices are located at Pontiac, Royal Oak, Mt. Clemens and Plymouth.

This division, with the many housing and industrial developments throughout the area, has experienced phenomenal growth, having increased the number of gas customers by 50 per cent since the end of World War II.

Natural gas space heating connections during the year 1950 increased the number of heating customers in the division by 191 per cent, to a total of 35,636 at December 15. This represents approximately one-third of Consumers Power Company's 105,000 space heating customers.

David L. Brown, Manager of the former Pontiac Division, continues as head of the new Southeastern Division, including the Pontiac District.

B. G. Campbell, Jr. has been appointed manager of the Royal Oak District. Campbell has been with the company since 1939 except for military service during World War II and had previously been division personnel and safety supervisor.

R. W. Clark, district manager at Mt. Clemens, was local manager in that city since 1934, prior to which time he was with the Northern Indiana Fuel & Light Co. at Auburn since 1918.

G. L. Mayhew, manager at Plymouth, joined the Consumers organization in 1937 and has served in various gas operating positions at Charlotte and Howell.

James J. Coon has been appointed gas superintendent for the division. He was formerly general gas distribution assistant at the Jackson headquarters. His assistant will be George W. Nehring who has been engaged in gas operations at Pontiac since 1925.

District gas distribution superintendents in the new organization plan are Robert J. Coyne, at Mt. Clemens, Victor W. Sisung, at Royal Oak, and James P. Thomas, Jr., at Plymouth.

East Ohio Gas Promotes Four to Top Positions

William G. Rogers

G. W. Horsley

John H. Carson

R. W. Ramsdell

J French Robinson, President of the East Ohio Gas Co., Cleveland, has announced the election of four executives to key management positions.

The elections were of William G. Rogers as executive vice-president and of George W. Horsley, Robert W. Ramsdell and John H. Carson as vice-presidents.

Mr. Rogers, who has been vice-president since 1939, joined the company as an engineer. He was named assistant secretary of the company in 1932, and was promoted to secretary and treasurer one year later. Rogers studied civil engineering at Case Institute of Technology, where he was in the class of 1915.

Mr. Horsley, general manager since 1949, joined the company after receiving his degree of bachelor of science in electrical engineering at Case Institute in 1915. Immediately prior to his appointment as general manager he served as general superintendent.

Mr. Ramsdell has been general superintendent since 1949. He came with the company shortly after his graduation from Case in 1928 with a degree of bachelor of science in civil engineering. During his 22 years service, he was manager of the Youngstown division from 1934 until 1944, when he was transferred to Cleveland as assistant general superintendent.

Mr. Carson is a graduate of Michigan College of Mining and Technology, with a degree of bachelor of science in metallurgical engineering, and also holds a master of science degree from Case Institute. He has been with the company for 17 years, serving as assistant chemist, assistant chief engineer, purchasing agent, and chief engineer.

C. B. Melton Named President Of Ohio Gas Co.

C. B. Melton has been elected President and a director of the Ohio Gas Co., Bryan, Ohio. He succeeds Frederick E. Zeuch, who has held the position since 1946.

Mr. Melton was President of a group of eastern gas properties with headquarters at Hagerstown, Maryland, prior to coming to Ohio Gas as vice-president and general manager in 1947.

He is a former President of the Bryan Chamber of Commerce, and is now chairman of the new industry committee of that organization.

FPC Postpones Phillips Hearing On Natural Gas Operations

The Federal Power Commission has postponed to a later date the hearing previously scheduled for January 8 in Bartlesville, Okla., in the proceeding involving FPC's investigation of Phillips Petroleum Company's natural gas operations.

Phillips had requested the commission to continue the hearing for the duration of the present national emergency because of obligations in the national defense effort.

Five New Officers Elected By Northern Natural

Five new company officers have been elected by the board of directors of Northern Natural Gas Co., Omaha, according to an announcement by John Merriam, President. Hiram J. Carson was advanced to first vice-president; Joseph T. Innis to vice-president in charge of operations; Larry Shomaker to vice-president in charge of sales; and John M. Hanley to vice-president in charge of gas supply. Myrven L. Mead was elected assistant to the President.

Mr. Carson received his engineering degree from Iowa State College and was operating head of a utility in Cedar Rapids before joining Northern Natural in 1930. He is a past President of the Midwest Gas Association.

Mr. Innis attended Kansas State College, Oklahoma A & M, and Panhandle A & M. He joined Northern Natural in 1930 as a field surveyor and worked his way up through the operating department. In 1943 he was made general superintendent of operations.

Mr. Shomaker is a graduate of the University of Wisconsin. He also started with Northern Natural in 1930. From a construction storekeeper, he held many jobs while advancing to his present position.

Mr. Hanley was graduated from Massachusetts Institute of Technology. In 1933 he joined Northern Natural and was promoted to head of the production department in 1942. During World War II, he served on a committee for the Petroleum Administration of War.

Mr. Mead joined Northern Natural in 1931, shortly after his graduation from the University of Nebraska. His first job was distribution engineer, and since then he has served in the construction, engineering, sales, and rate departments.

Five Supervisory Changes Made In Operation At Peoples Gas

Changes affecting five men in supervisory positions were recently made in the operating division of The Peoples Gas Light & Coke Co., Chicago.

Henry J. Sterk, formerly superintendent of the motor repair department, was transferred to south district shop as superintendent, succeeding John F. Linehan, who has retired.

Thomas R. Bogumill, formerly superintendent of 110th st. station, became superintendent of the meter repair department. Succeeding him is Edwin W. Andrews, formerly assistant superintendent at Division st. production station.

Harold E. Greenlee, formerly assistant superintendent of north production station and Hawthorne distribution station, became assistant superintendent of Division st. production station and North Shore avenue distribution station.

Samuel W. H. Gibson, formerly general foreman at Crawford station, succeeds Mr. Greenlee at north production station and Hawthorne distribution station.

Cressman Succeeds P. A. Wilson As Asst. Sec'y., Phila. Elec.

P. A. Wilson, assistant secretary of the Philadelphia Electric Co. retired December 31, after 50 years of service. He had been in utility work for his entire business career.

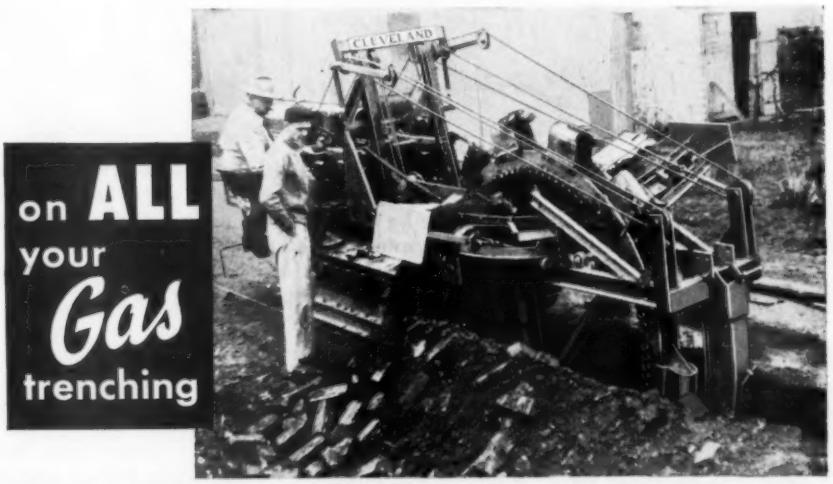
Howard H. Cressman has been elected to succeed Mr. Wilson as assistant secretary. Mr. Cressman has been with Philadelphia Electric since 1911.

Cassidy Is Named Chairman Of Water Heater Division

A. F. Cassidy, of New York, manager of the water heater sales division, Rheem Manufacturing Co., New York, has been elected to the chairmanship of the Gas Water Heater Division of the Gas Appliance Manufacturers Association.

Mr. Cassidy has been active in the gas industry for many years and has served the Consolidated Edison Co., Gas Appliance Manufacturers Association, and the Rheem Manufacturing Co.

Mr. Cassidy succeeds Leland Feigel, Servel, Inc., as chairman.



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SALESMEN BEWARE OF THESE MEN!

A doleful peddler in black inspired C. T. "Cy" Burg, President of Iron Fireman's sales subsidiary, to go all out for the cheerful "red ties and gray suits" which he has made synonymous with successful selling. Here he is ready to set up the third bogey man, "Delay," for Portland Gas & Coke Co. salesmen to knock down. At the Portland, Ore., meeting he reported that his firm's gas equipment sales nationally increased 110 per cent during 1950.

Transcontinental to Build Line Direct to Brooklyn

Presiding Examiner Emery J. Woodall of the Federal Power Commission has filed an initial decision, subject to review by the commission, authorizing Transcontinental Gas Pipe Line Corp. of Houston, to construct an extension of its main pipe line to provide an auxiliary connection for delivery of natural gas to the Brooklyn metropolitan area.

Lattner Announces Manufacture Of New Tubular Boilers

The P. M. Lattner Mfg. Co., Cedar Rapids, Iowa, manufacturers of industrial gas boilers, announces a new line of portable horizontal return tubular boilers. Previous to this they have specialized in the small vertical type exclusively.

The new line is being built in small sizes only, ranging from three horsepower to 25 horsepower inclusive. A feature is the use of silent atmospheric burners fitted to a tunnel type combustion chamber. This combustion chamber is completely lined with high temperature fire brick at the factory. Each boiler is shipped complete with fire brick installed and no setting is required on the job. A heavy rock wool insulated jacket is furnished installed on the boiler shell.

Full automatic control equipment includes a combination of high-low fire control in conjunction with electric off-on control with safety pilot. The amount of gas going to the burners is reduced before the off-on controls go into operation.

This new line of boilers was field tested for nine months. Boilers now in production are for 100 lbs. steam operating pressure. Boilers for higher steam pressures will be introduced later.

FPC Orders Colorado Interstate To Supply Gas to Trinidad

The Federal Power Commission has ordered Colorado Interstate Gas Co., of Colorado Springs to connect its pipe line facilities with those proposed to be built by the City of Trinidad, Colo., and to deliver and sell up to one million cu. ft. of natural gas per day for local distribution in Trinidad.

The city will build a 35-mile pipe line extending from the proposed point of interconnection on Colorado Interstate's Panhandle-Denver transmission line to a distribution system to be built in Trinidad. Estimated construction cost of the transmission and distribution facilities is $1,100,000.

Lloyd A. Hunziker Promoted By Brooklyn Union

Lloyd A. Hunziker, Brooklyn Union Gas Co., has been named assistant construction engineer, it was announced recently.

Mr. Hunziker joined the company in 1932 as a trainee. He was in turn a utilization assistant, a junior industrial sales engineer, industrial sales engineer, and engineer of industrial gas utilization. In 1947 he was transferred to the construction department and made senior engineer.

Mr. Hunziker is a graduate of Polytechnic Institute of Brooklyn, from which he received his BME.

Edward Salner Becomes Manager Of Koppers Precipitator Dept.

Appointment of Edward Salner as manager of the precipitator department of the metal products division of Koppers Co., Inc., was announced recently by Walter F. Perkins, vice-president and general manager of the division.

Mr. Salner succeeds Frank H. Linthicum, who died on December 11, 1950.

A native of McKeesport, Pa., Mr. Salner received a bachelor of science degree in industrial engineering at Purdue University. He joined Koppers Metal Products Division as personnel manager in 1939 and became assistant works manager in 1942. Two years later he was transferred to the company's tar products division as industrial relations manager.

In 1945 he joined the US State Department as labor attache at the US Embassy in Vienna. He returned to Koppers as a sales engineer in the precipitator department in 1947 and the following year was named assistant manager of that department.

CONVENTION CALENDAR

January

22-25 The American Society of Heating and Ventilating Engineers, Philadelphia.

March

12-14 Mid-West Gas Association, Hotel Fontenelle, Omaha, Nebr.

29-30 NEGA Annual Meeting, Hotel Statler, Boston.

29-30 Oklahoma Utilities Association, Mayo Hotel, Tulsa.

April

10-12 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman, Okla.

16-18 AGA Distribution, Motor Vehicles and Corrosion Conference, Hotel Peabody, Memphis.

16-18 GAMA, Annual Meeting, Drake Hotel, Chicago.

19-21 Florida-Georgia Gas Association, Spring Convention, Hollywood Beach Hotel, Hollywood Beach, Florida.

May

7-8 AGA Natural Gas Department, spring meeting, Baker Hotel, Dallas, Texas.

7-9 Missouri Association of Public Utilities, annual convention, Jefferson Hotel, St. Louis.

14-16 AGA Production and Chemical Conference, Hotel New Yorker, New York.

Rheem Is Planning to Produce New Gas Refrigerator

Rheem Manufacturing Co. is preparing to produce and market a new gas absorption type of household refrigerator, President R. S. Rheem announced recently.

The refrigerator, developed by Clayton and Lambert Manufacturing Co., Louisville, will be made by Rheem under an exclusive agreement just concluded between the two companies.

In the process of development and testing for more than five years, the new refrigerator will be available in popular capacities. It will be sold under the Rheem name. Intensive field and laboratory tests have shown high operating performance and efficiency. Further testing and design study will be carried out prior to manufacture of the unit in commercial volume.

"The decision to produce this completely new gas refrigerator is another major indication of our unbounded faith in the future of gas as the popular household fuel," Mr. Rheem said.

Servel Comment:

Servel, Inc., which has been manufacturing gas absorption type household refrigerators for 25 years, welcomes the entrance of other substantial companies in the gas refrigerator field.

This was the comment of W. Paul Jones, Servel President, on being informed that the Rheem company had announced plans to manufacture another gas refrigerator.

"We do not know any of the details of Rheem's plans to go into the gas refrigerator business," Mr. Jones said, "but we will welcome any good, substantial company that will come into the industry, and help to develop the vast market for gas refrigerators.

"With the availability of natural gas in ever-increasing volume, there is a corresponding upsurge in the public's interest in gas operated appliances. The entrance of another company in the gas refrigerator field is further evidence of the great acceptance of the modern, motorless type of refrigerator by the homemakers of America."

New Transit-Maintenance Body Made by McCabe-Powers

A new transit-maintenance body has been added to the Powers-American line of public utility bodies and equipment. Arranged to permit transit for four men, in addition to those in the truck cab, this new unit also provides compartment space for carrying tools and materials.

Compartments may be equipped with shelves, trays, and bins to meet the requirements of any operation. The body roof may be fitted with hand rails and hold-down straps, or can be equipped with ladder racks and material brackets. Inside seating arrangement can be altered to fit individual needs.

Court Decides

(Continued from page 32)

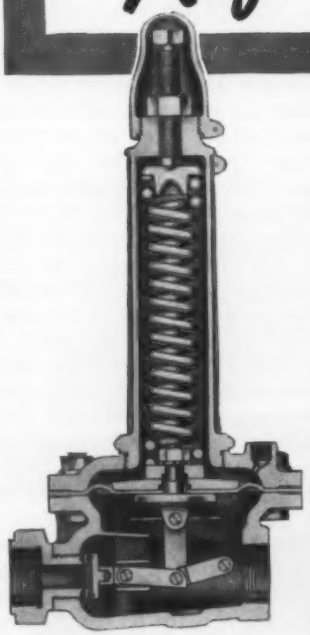
fund the sum of approximately $176,000, plus interest.

The order of the commission reducing the wholesale rates was sustained by the courts. Hence there was on deposit the above mentioned sum of money for distribution.

Although counsel for the Citizens Utilities Co. argued that 50 per cent of this sum should be paid to it, the higher court decided that the full sum on deposit should be distributed to the retail consumers. This court said:

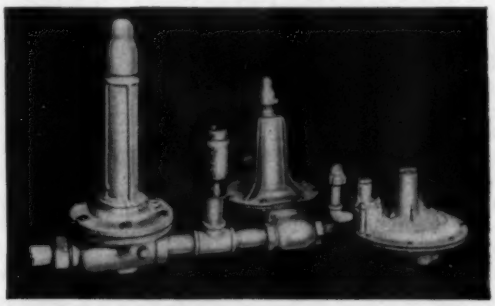
"The reasonableness of rates charged by the companies who claim the fund, is wholly ancillary to the problem of determining what claimants are equitably entitled to share in it. . . . The intervenor's (Citizens Utilities Co.) customers are the sole owners of the fund in question. The Citizens Utilities Co. has no right, title or interest therein; and the fund is held in trust for those from whom it was unlawfully taken. . . . The intervenor having no right, title or interest in the fund, is in no position to raise technical objections in proceedings in which it is not concerned, and should not be permitted to further delay the distribution of said fund among its rightful owners."

IN THE HIGH PRESSURE FIELD
THERE IS SAFETY
IN *Reynolds...*



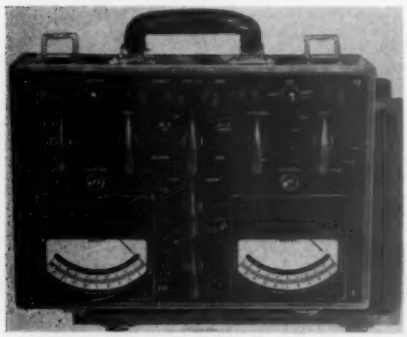
Accurate, Safe Control

of tremendous pressures is an ever present problem in the gas field. Reynolds field Regulator illustrated at left is one of the many high pressure regulators built by Reynolds. It is thoroughly tested and proved in service. It handles up to 1,000 pounds safely reducing same to pounds. For more than fifty-five years Reynolds has designed and built gas regulators. Safety, accurate performance, years of service—these are some of the built-in factors responsible for Reynolds enviable position in the Gas Control Field.



Reynolds Gas Regulator Co.
ANDERSON, INDIANA, U. S. A.
GAS CONTROL SINCE 1892

M. C. Miller Has New Meter For Corrosion Testing



A new model, the B-3, of the multi-combination meter for electrolysis, corrosion and cathodic protection testing, is now available from the manufacturer, M. C. Miller, West Englewood, N. J.

The manufacturer claims that with this multi-combination meter, practically all measurements encountered in electrolysis and corrosion investigations and cathodic protection testing in field and laboratory can be made. By use of a circuit selector switch, the two d-c instruments can be connected into a variety of measuring circuits for measurement of potentials, current, resistance and soil resistivity. Internal batteries with switch and coarse and fine controls can be used to supply and control current for test purposes. Voltmeters, or voltmeter and ammeter can be used separately or simultaneously. Polarity reversing switches are provided for both current and potential measurements, according to M. C. Miller.

Geyer Leaves So. Counties Gas To Join Robertshaw-Fulton

Helmut W. Geyer has resigned from his position of utilization engineer for the Southern Counties Gas Co., Calif., to take an appointment as director of the west coast research and development laboratory, Grayson Controls Division, of the Robertshaw-Fulton Controls Co. He took over his new post on January 1, 1951.

Mr. Geyer has been with Southern Counties since 1929, when he went to work as research engineer on problems concerned with appliances and automatic controls in the domestic, commercial and industrial fields. In 1931 he was appointed utilization engineer in charge of all utilization activities.

A graduate of Massachusetts Institute of Technology, Mr. Geyer has degrees of bachelor of science in electrical engineering and master of science in fuel and gas engineering. He has been twice chairman of the Utilization Committee and twice chairman of the Committee on Codes and Ordinances of the Pacific Coast Gas Association. From 1941 to 1949 he was chairman of the American Gas Association Requirements Committee for Gas Water Heaters.

Investment Advisers

(Continued from page 27)

supplies for long periods of time would presumably enhance the value of all the securities of the enterprise and to the extent that it is necessary to raise capital will probably result in considerably lower costs than might otherwise be the case. Furthermore, if the gas is exhausted, the investor has nothing left but pipe in the ground, whereas the consumer presumably could turn to other fuels."

As against this it is asserted that: "Neither rate payer nor security holder should be required to pay an extra premium for heavy long term commitments on natural gas supplies. The quest for oil should continue to uncover liberal volumes of gas for many years to come. Recycling gas will also come on the market at some future time. It seems that the FPC should be more liberal in granting certificates where the retail market seems assured. Future rate payers should be given the advantage (or pay the cost) of gas as it is uncovered."

Panhandle Eastern Example

"Why should the stockholder be squeezed in favor of the consumer?" is the question asked by some investment advisers anent the advisability of permitting pipe line managements to dispose of reserves relied upon in certificate proceedings. "More of the pipe line companies with owned reserves should distribute all or part of them to stockholders," they insist, "as Panhandle Eastern Pipe Line Co. did a couple of years ago when it segregated some 600,000 acres of gas reserves in a new company and then distributed the latter's stock to its own shareholders. These companies then could make new gas purchase contracts at the going rate and let their stockholders in turn have the benefit of obtaining the going rate for gas underlying the acreage given them in distribution."

"The disposal of gas reserves is the security holders' worry," according to these observers. "Presumably, the management is working for its stockholders and it seems unlikely that any steps would be taken which would jeopardize the business of the company and hence the gas available to its customers.

"The owned reserves of natural gas should be disposable at the company's option, but only with the consent of senior security holders . . . and provided such companies are able to obtain gas supplies elsewhere sufficient as not to impair services to the public or adversely affect the value of the securities to a company's security holders."

While comments on this second question are about evenly divided *pro* and *con*, some observers have hewed to a middle of the road reply.

"The question is not as clear as the wording would imply," one of these observers reasons. "Certainly on the surface few people would say that natural gas companies should be free to dispose of gas supplies which have been relied on in certificate proceedings without approval of the Commission. The difficult phrases are 'dispose of' and 'have been relied on.' Sometimes disposition can be accomplished without losing the commitment or dedication of the gas supply to the pipe line. Where this can be done there are good arguments for freeing the production business from some of the restraints of regulation imposed on pipe line transmission business. This would enable the investors to realize on the value of their investment in production facilities. With respect to the second phrase, there may be an area of uncertainty as to how strongly the gas supplies have been relied upon in certificate proceedings. Where the reliance has been remote and difficult to prove, I think more latitude should be granted the pipe line companies in disposing of gas supplies as they see fit."

As against this, another well qualified observer states that: "Concerning the question whether natural gas companies should be free to dispose of gas supplies which are the basis of certificate grants by the FPC, I believe that ordinary good business sense would dictate a negative answer. However, there are many facets to this question, with the implication ringing loud that once a certificate was secured, the pipe line purchaser of gas would abdicate his responsibility to consumers and investors by allowing his future supplies to be jeopardized.

No 'Sharp' Dealing

"From my knowledge of pipe line companies, I feel that if any adjustment in controlled reserves was requested, it would probably be based on sound business practices, and not 'sharp' dealing. The producer's position might be that certain allocated reserves could be marketed more economically or more advantageously somewhere else, or the additional reserves coming in sight might lead to redisposition of allocated reserves. The commissioner's question suggests in my mind a 'trial balloon' to sound out the investment community's feelings on FPC control of natural gas producers. As a natural resource industry, the natural gas field has radically different problems confronting it than the strict 'utility' type company where most of the factors are susceptible to pretty close analysis and forecast. That would be a subject for a long debate in itself; suffice to say, I am strongly against FPC regulation of any such natural resource industry.

Hemes Named General Manager Of Vulcan Rubber Products

E. C. Hemes

J. H. McGourty

Edward C. Hemes has been appointed general manager of Vulcan Rubber Products, Inc., Brooklyn, N. Y., manufacturers of industrial rubber coated fabrics.

Mr. Hemes, who previously was manager of the gas meter diaphragm division of the company, has been with the organization since 1946. Prior to that he was with the Milwaukee Gas Light Co. for 19 years as superintendent of meters and assistant superintendent of the company's west side plant, where his experience included various phases of gas distribution and LP gas production. He is a graduate of the University of Wisconsin and served three years as a member of the American Gas Association meter committee.

McGourty Joins Company

James H. McGourty has joined Vulcan Rubber Products in a sales capacity. He has been associated for the past five years with the Superior Meter Co. as east coast sales manager and director of labor relations. He has been active in affairs of the various gas associations and has contributed articles to the gas industry trade papers.

Central Hudson Has Big Jump In House Heating

Arrival of natural gas from Texas has resulted in installation of 805 gas house heaters in the Mid-Hudson Valley since January 1, 1950, the Central Hudson Gas & Electric Corp. has announced.

This compares with 1350 gas house heaters installed during the preceding 24 years since Central Hudson first sold gas for house heating in 1926.

Company officials stated that the house heaters installed so far this year will consume approximately 100,000,000 cu. ft. of natural gas annually. It is estimated that the company will have 2350 house heating customers by the end of 1950. According to its engineers, however, it can serve 8000 gas house heating customers without further substantial increase in its distribution or transmission systems.

Southern Natural To Expand In Mississippi and Alabama

The Federal Power Commission has authorized Southern Natural Gas Co., of Birmingham, to construct line taps and metering facilities for the delivery and sale of natural gas to two natural gas districts in Mississippi—the North Central district and the Carthage district—and to two towns in Alabama—Aliceville and Carrollton.

The North Central district will construct about 98.5 miles of pipe line from Southern Natural's system in Mississippi. Upon completion of the construction, estimated to cost $1,950,000, the district plans to lease for a 25-year period all of the facilities to Mississippi Gas Co., a wholly-owned subsidiary of Southern Natural. The Mississippi Gas Co. will operate the entire system.

The Carthage district will build approximately 16.5 miles of line extending from Southern Natural's system in Mississippi to the town of Carthage together with a distribution system within that community at a total over-all cost of $290,350. The Carthage district plans to lease all of these facilities to Mississippi Power & Light Co., who will operate the entire system.

The towns of Aliceville and Carrollton, Ala., will build and operate necessary transmission and distribution facilities at an estimated total cost of $536,000.

P. V. Cheli Is Named Manager Of Bryant's Chicago Branch

Peter V. Cheli was recently appointed manager of the Chicago branch office of Bryant Heater Division, Affiliated Gas Equipment, Inc. The announcement from Bryant headquarters in Cleveland reported that he succeeds William H. Wise, who has joined the home office organization as assistant to J. N. Crawford, director of sales.

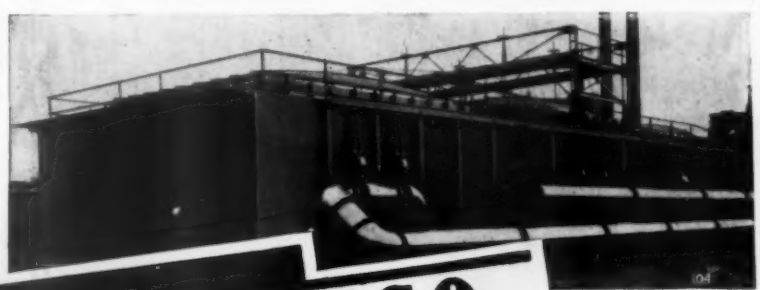
Mr. Cheli began his association with the gas industry in 1934 when he joined the sales organization of the Peoples Gas Light and Coke Co. in Chicago. He served with the War Production Board and later the War Assets Administration.

Mr. Cheli joined Bryant's Chicago branch in August 1949.

Surface Combustion's Bulletin Describes Furnaces

Bulletin (SC-148) describing five standard rated atmosphere furnaces has just been released by Surface Combustion, Toledo!

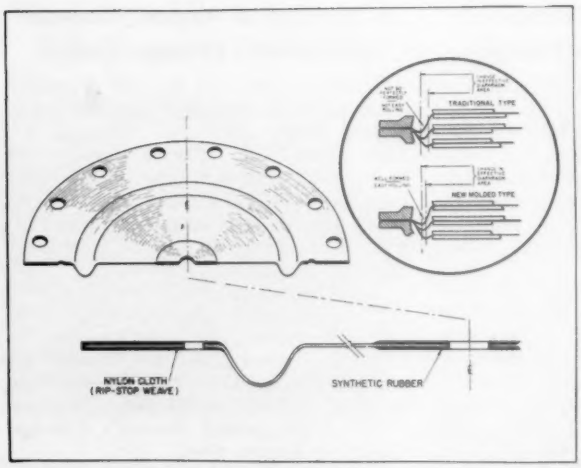
The applications of each of these furnaces to modern, controlled atmosphere heat treating are described in detail. The atmosphere generators, burner equipment and other factors are presented. The compositions of the most widely used heat treating prepared atmospheres and the generators in which they are produced are also described.



STAMANCO GAS PURIFIERS

STAMANCO Purifier Boxes are designed to your specific operating and service conditions--thus assuring utmost efficiency and economy. Made in any style or capacity. We design, build, and install STAMANCO Purifier Boxes complete with all trays, piping, valves, gantry cranes, and equipment for the economical handling of oxide materials. Let us figure on your requirements.

The STACEY MANUFACTURING Co.
CINCINNATI 16, OHIO
SINCE 1851
GAS HOLDERS • HI-PRESSURE TANKS • PURIFIER BOXES
ENGINEERS • FABRICATORS • CONSTRUCTORS
An Independent Organization Not Affiliated With Any Other Builders of Gas Holders



New type molded synthetic diaphragm strengthened with nylon as developed by Rockwell Manufacturing.

New Nylon-in-Rubber Diaphragm Improves Regulation

To improve the precision of gas pressure control with high pressure balanced valve pilot loaded regulators, to aid in the assembly of the diaphragms in such equipment, and to increase the period of trouble-free regulator service with respect to diaphragm maintenance, the Rockwell Manufacturing Co., Pittsburgh, has developed a new-type diaphragm of molded synthetic rubber strengthened with nylon fabric. The new diaphragm replaces the traditional flat leather or synthetic diaphragms.

Among the more significant construction details are: (1) the heat molded shape of the circular trough which lies between the case clamping ring and the diaphragm clamping plates; (2) the extra rubber thickness at both the peripheral and central clamping zones; and (3) the type of weave used for the inserted fabric and its position within the diaphragm.

A company announcement stated that because of its molded torus shape, the free area of the diaphragm rolls easily and smoothly. Consequently, pressure variations due to changes in effective diaphragm area with change of diaphragm position are minimized. The second feature—extra thickness of rubber at clamping areas—provides greater ease of assembly, insures sealing and reduces to a minimum any possibility of cutting the diaphragm due to its being clamped between flanges. Seepage of high pressure gas along the fibers of the inserted fabric is prevented by the special type of weave employed and by the sealing-off of the nylon insert well back from the outer diaphragm edge.

The rubber composition is selected for its resistance to those fractions of hydrocarbons encountered in gas pressure regulator applications.

This new diaphragm is being initially applied to pilot-load balanced valve regulators; however, its many features can be incorporated in diaphragms for other types of regulators.

Frederick C. Freeman Is Dead; Was Providence Gas President

Frederick C. Freeman, 68, former President of the Providence Gas Co., died after an operation at the Rhode Island Hospital in November.

A native of Jersey City, he was consulting engineer with the United Gas Improvement Co. of Philadelphia. He joined Providence Gas in 1919.

He had been President of the New England Association of Gas Engineers and of the New England Gas Association. He had also been a director of the American Gas Association.

M-SCOPE Pipe Finder

LIGHTWEIGHT MODEL

One Man Operation On Every Application

HIGHLY EFFICIENT

IMMEDIATE SHIPMENT

Free Demonstration and Operating Instructions

Catalog No. 25M On Request

JOSEPH G. POLLARD CO., INC.

Pipe Line Equipment

New Hyde Park **New York**

SULFUR-FREE GAS

AT LOWEST COST

WITH IRON SPONGE

Iron Sponge is a concentrated purification material that operates with high efficiency at high or low pressures, has excellent capacity and activity, gives long service between foulings and is simply and quickly regenerated. This is why Iron Sponge has been preferred for H_2S removal for over 75 years.

CONNELLY, Inc.

3154 S. California Ave., Chicago 8, Ill.
Elizabeth, N. J. • Los Angeles, Calif.

Daniel L. Scott Dies in Calif.; Had Long Advertising Career

Daniel L. Scott, former advertising manager and personnel director of the Southern California Gas Co., died recently at the age of 70 at Arlington, Calif.

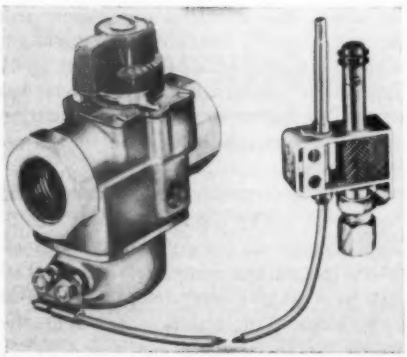
Born in West Newton, Pennsylvania, he joined Los Angeles Gas and Electric Corp., a predecessor of Southern California Gas Co., in 1908 as a clerk. He became advertising manager in 1924 and, a year later, manager of public relations.

Following the merger of the two companies in 1937, Mr. Scott became manager of publications. At the outbreak of World War II he again became advertising manager of the company.

Rockwell Names Daugherty Market Research Manager

The appointment of A. C. Daugherty as manager of market research for the Rockwell Manufacturing Co., Pittsburgh, has been announced by W. F. Rockwell, Jr., President.

Mr. Daugherty joined Rockwell as a student engineer upon graduation from Penn State. In 1947 he became a market analyst in the company's market research department. He is a director of the Pittsburgh Chapter of the American Marketing Association.



Two New Products Announced By General Controls

Two new General Controls products, a new MR-5, ¾" gas cock safety valve and the 260 series pilot burner, were announced recently by J. F. Ray, vice-president in charge of sales.

The new products are both precision-made to accommodate the requirements of adequate heating control, said Mr. Ray, while providing the means for absolute safety and low fuel consumption.

The new pilot burner is designed on a smaller scale than its predecessors. The mounting bracket, designed for various types of appliance installation, holds both the burner and the thermocouple in operating relation to each other.

Like other models of the General Controls safety type control valves, the new ¾" MR-5 includes the safety shut-off feature, in the event of pilot flame failure. The plastic, manual reset handle may be removed to expose a rod fitting device for use with floor furnace installations.

Dr. Gustav Egloff Selected For Two Lectures

The University of Edinburgh's Senatus Academicus has elected Dr. Gustav Egloff, Universal Oil Products Co., to give the biennial "Romanes Lecture in Chemistry for 1951."

Dr. Egloff, who is vice-president of the Third World Petroleum Congress, will attend the Third Congress, in The Hague, May 28 to June 6, at which time he will lecture on "Polymerization of Olefinic Hydrocarbons."

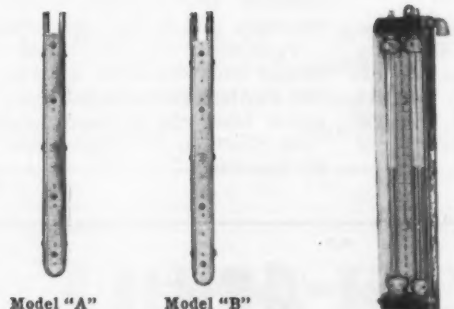
Two New Bulletins Available From Cleveland Heater

Two new bulletins, "The Story of the Magic Wand" and "The Anodic Rod, What It Is and How It Works," are now available from The Cleveland Heater Co., Cleveland 14.

Both illustrated bulletins explain corrosion and rust formation and how the Elno anodic rod may prevent them. The installation of the anodic rod is also described.

NORWALK MANOMETERS

For Water, Mercury, Oil or Glycerine



Model "A" Service Type Ideal for Serviceman's Kit

Model "B"

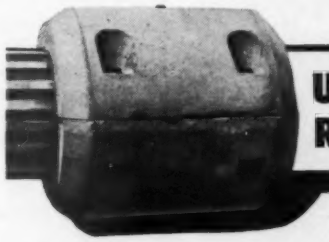
Heavy Duty Type

For pressure or vacuum use. Made in all sizes and types. Service Type has unbreakable tubing and will stand abuse. Send for bulletin 3100M for complete data and prices.

NORWALK VALVE COMPANY

South Norwalk, Conn.

Manufacturers of Norwalk-Connelly Regulators since 1878



UNIVERSAL RIVER WEIGHTS

safeguard **Tennessee Crossing**

Tides, floods, currents and shifting sands cause lines crossing bodies of water to "buoy-up," move laterally, even spring leaks. Texas Gas Transmission Corp. of Owensboro, Ky., safeguards against such events by installing Universal River Weights on two of their lines crossing the Tennessee River. They found it the economical way to add necessary weight.

write for the complete story of the Tennessee Crossing and additional information on River Weights and sizes available.

Photo shows how pipe line is "floated" across river.

Plants in: Decatur and Dothan, Alabama; Tampa and Ocala, Florida; Atlanta, Georgia; Kenvil, New Jersey; Binghamton, Port Washington, Rochester and Syracuse, New York; Columbus and Zanesville, Ohio; Norristown and Pittsburgh, Pennsylvania; Nashville, Tennessee; Clarksburg and New Martinsville, West Virginia.

Universal CONCRETE PIPE CO.

General Offices: 297 South High St., Columbus, Ohio

Reserves and Interconnections

(Continued from page 28)

revision of the service area provision, section 6(f), of the Natural Gas Act. This, I am sure both the industry and the commission would appreciate.

While almost a century has passed since the drilling of the Drake well, near Titusville, Pennsylvania, and the discovery of oil and gas, it has been in comparatively recent years that the natural gas industry has moved out from under the cloud of suspicion, primarily based on the theory that the natural gas supply was unstable, unreliable and unknown. In short, that it was a completely risk venture. Indeed financing of natural gas companies was on a 100 per cent stock issue basis principally because there was no authoritative source for information on the quantity and location of gas reserves.

With the enormous discoveries in the southwest area, the old method of financing natural gas companies by stock issues has almost completely reversed itself by swinging over to a 75 per cent debt ratio. The question is: Will the pendulum swing again the other way? A probable answer is that it will, unless we can keep up-to-date on full reserve information. We must constantly check against Mr. Terry's minimum figure.

FOR REPAIRING BELL AND SPIGOT JOINT LEAKS...

SKINNER-SEAL Bell Joint Clamp for stopping bell and spigot joint leaks under pressure. Gasket is completely sealed: at bell face by Monel Metal Seal band—at spigot by hard vulcanized gasket tip.

AND BROKEN MAINS

SKINNER-SEAL Split Coupling Clamp. One man can install in 5 to 15 minutes. Gasket sealed by Monel band. Tested to 800 lbs. line pressure. A lasting repair. 2" to 16" incl.

M. B. SKINNER CO.
SOUTH BEND 21, INDIANA, U.S.A.

Utah Pipe Line Seeks FPC OK For New Mexico-Utah Line

Utah Pipe Line Co. of Dallas has asked the Federal Power Commission for authority to construct and operate a 392 mile natural gas transmission line extending from a point near Aztec, N. M., to the Salt Lake City area. Estimated cost of the project is approximately $22,000,000.

The company, recently formed for the purpose of constructing the proposed pipe line, plans to serve natural gas primarily to industrial consumers located in the Salt Lake City area, and also proposes to serve towns and communities along the route of its system in Colorado and Utah.

The system would have a maximum capacity of 96 million cu. ft. per day. The company estimates initial daily demand as ranging from 60 million to 95 million cu. ft.

Ebasco Moves to New Office In Washington, D. C.

Ebasco Services has opened a new and enlarged Washington, D. C., office at 1625—"I" Street, N.W. The new office is centrally located in a modern office building just completed, and will continue under the management of W. B. Cosdon.

Through use of these expanded facilities, Ebasco states it now will be better equipped to meet the requirements of the clients served in the Washington area, where the firm has maintained an office since 1941.

Detroit-Michigan Wins First Cooking Appliance Medal

Left to right: John A. Fry, Emil Hartman, and Fred Kaiser.

First gold medal ever bestowed upon a cooking appliance by the Fashion Academy of New York was awarded Dec. 15 to the 1951 line of Detroit Jewel and Garland gas ranges for "distinctive design and superior styling."

The award was presented by Emil Hartman, director of the academy and well-known fashion analyst, to John A. Fry, President, and Fred A. Kaiser, vice-president, of Detroit-Michigan Stove Co. in ceremonies at the school.

"Aware that the beauty of her kitchen is so close to a woman's heart, and that the stove has been, and still is, the focal point of interest in that kitchen, the Detroit-Michigan Stove Co. has designed its 1951 line of ranges with skilled craftsmanship and inspired artistry," Mr. Hartman said in presenting the medal.

Pointing to the importance of good design and beauty in today's kitchen, Mr. Fry termed "most gratifying" recognition from the Fashion Academy of "our efforts to still further beautify the kitchen range."

CLEVELAND

"A" TYPE METERS
"B" TYPE METERS
DIAPHRAGMS

Cleveland Gas Meter Co.
ESTABLISHED 1875
2009 Rockwell Ave., Cleveland 14 O. Phone CHerry 2351

GPM
The mark of unerring dependability in purification
GAS PURIFYING MATERIALS CO., INC.
3-15 26th Ave.
Long Island City 2, New York

C. S. Goldsmith Retires From Brooklyn Union

C. S. Goldsmith, engineer of distribution, Brooklyn Union Gas Co., has retired after 20 years of service, it was recently announced.

Starting with Brooklyn Union as a superintendent's assistant in 1921, Mr. Goldsmith was soon placed in charge of transportation in the shop distribution department. In 1926 he was made assistant superintendent of the distribution department, and, in 1928, engineer of distribution design. Later he became engineer's assistant, then assistant engineer of distribution. In 1941 he was named engineer of distribution.

He has been active on numerous committees of the American Gas Association, being chairman of the Technical Section during 1946 and 1947. He has also written articles which have appeared in many technical publications.

Classified

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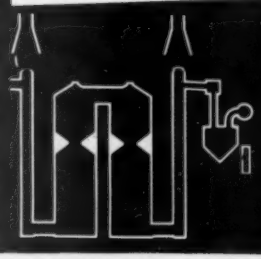

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Gas Orifice Meter

(Continued from page 22)

actual pipe itself, shut-off valves to isolate the meter, a by-pass valve to permit equalizing the pressures in the meter housings for the purpose of checking the meter zero reading, and a bleed valve to permit ready reduction of the meter pressure for inspection and other checking operations.

The shut-off valves are preferably located at the orifice flanges. If the meter is located some distance from the orifice flanges, an extra set of block valves can be installed at the meter for convenience of the operator. However, if the gas being handled contains water or gasoline vapors which can condense into liquid, the shut-off valves, whether at the flanges or at the meter, should be the full opening type to prevent liquid from becoming entrapped in them, and, thereby, creating a false differential pressure.

Whenever possible meter piping should be as short as is practical. Also, the most direct path between the orifice flanges and the meter should be taken. Furthermore, if the gas flow has pulsative characteristics, less inaccuracy as the result of the pulsation will be experienced if both branches of the meter piping are identical in shape and length. At best, with any orifice-type flow meter, pulsating gas flows are measured with only a diminished degree of accuracy. Yet, taking precautions of this type will reduce the errors.

Since it contains no free liquid, the dual-bellows type meter may be connected either at the bottom or top of the meter housings. Therefore, for measurement of gas flows when the meter is above the orifice plate, the meter piping may be dropped from the meter direct to the flanges. Should condensate form in the gas as the result of a drop in atmospheric temperature, it can drain from the bottom connections right back into the pipe line, thereby preventing serious measurement inaccuracies.

New Capital Support

(Continued from page 26)

far from cohesive get-together between the state and federal agencies.

On the score of rate increases he stated that since January 1, 1950 natural gas companies filed with FPC 18 cases requesting $15,846,000 of annual rate increases. Of these, $53,000 have been withdrawn, $5,550,000 are under suspension, and nearly $10,243,000 have become effective, with $8,650,000 in this last category still under investigation and placed in effect under bond.

He complimented the natural gas industry on its satisfactory depreciation practices and he sounded a favorable note on the question of the end use of natural gas.

On this score he said: "I do not yet see, in terms of what appear to be reasonable reserve prospects, any reason for denying the advantages of natural gas to areas which do not now enjoy them or any occasion for a general limitation by fiat of the uses to which natural gas may be put. To be sure that it would now be wise to proscribe present use for the sake of possible future need would require more prescience regarding the next quarter of a century than I possess. However the over-all picture unfolds in terms of demands, discoveries, and alternative sources of energy, it is altogether likely to develop gradually enough so that we may adapt ourselves to it and make the necessary adjustments as we go along.

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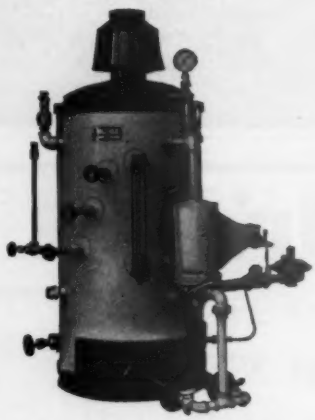

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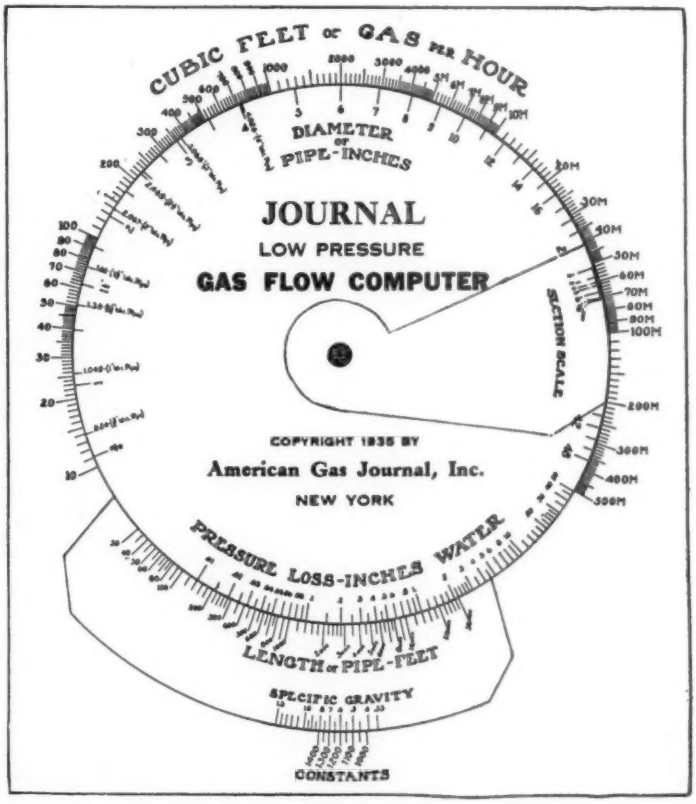

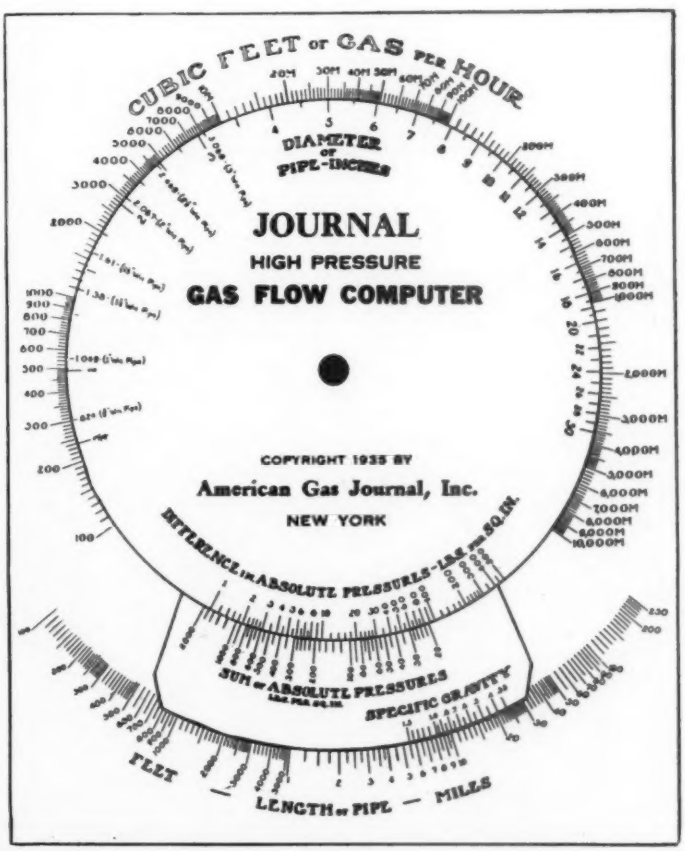

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